



MotionXtra® HG-100K



MotionXtra® HG-LE



MotionXtra® HG-TH

User's Manual Version 3.4.0



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Version 3.4
February 2005
PN 91000122-003

Precautions

Controller Heat Sink Device!

The HG-TH Controller will operate satisfactorily in most environments (for example, on a workbench or tabletop) with the heat sink and rubber feet mounted. The rubber feet and heat sink may be removed if the Controller is mounted on a metal object that will act as a heat sink. For more information, see [HG-TH Camera Controller Dimensions and Mounting Holes](#), page 94.

Temperature

The HG-100K/LE will operate satisfactorily in an environment where the ambient temperature is between -0°C and 45°C (32°F and 113°F). The HG-TH will operate in an environment where the ambient temperature is between -0°C and 40°C (32°F and 104°F). The maximum humidity is 80%, non-condensing, at 40°C .

Battery

The HG-100K/LE/TH battery pack contains small amounts of harmful substances. A battery pack may explode if it is incorrectly replaced, exposed to fire or water, short-circuited or disassembled. Do not put batteries in trash that is disposed of in landfills. Replace with approved batteries only. When disposing of depleted batteries, comply with local ordinances and your company's safety standards.

Laser

Do not focus a laser beam on the sensor directly or by reflection, it will cause permanent damage to the sensor. Any laser powerful enough to produce localized heating at the surface of the sensor will cause damage, even if the [camera](#) power is off. Laser-damaged sensors are NOT covered by the warranty.

Storage

Use the original shipping carton when transporting the HG-100K/LE/TH camera and Hub Sync Unit (HSU). If you must ship your imager frequently, you may wish to purchase a carrying case. Please contact your Redlake representative for details.

Signal Levels

Always check the voltage on the trigger line before connecting to the camera. Signal levels above 5 volts at the Sync In and Trigger In TTL inputs can cause permanent damage to the system. For additional information, see [Configurable Connector](#), page 102 and [Trigger Input Connector](#), page 103.

Shock and Vibration

An operational Camera Controller, Camera Head and their interconnecting cables (Tether, STP, and Gigabit Ethernet) have been tested to withstand a half sine pulse, 100G, 6 ms pulse width and 1000 shocks in each of 3 axes. An operational [Camera Controller](#) and Camera Head, along with their interconnecting cables (Tether, STP, and [1000Base-T](#) Ethernet), have been tested to withstand a sine sweep from 5 to 2500 Hz, at 1 octave per minute, at 5G rms, in each of three axes.

Bend Radius on the HG-TH Tethered Head Cable

Do not Bend the HG-TH Tethered Head cables at an angle greater than 90 mm. It will cause permanent damage to the cable and will adversely affect the downloaded images.

Declaration of Conformity

FCC Declaration

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Table of Contents

Contact Information	i
Precautions	ii
Declaration of Conformity	iv
1. Introduction	1
1.1. System Overview	1
2. Practical Applications	3
2.1. Vehicle Impact Testing	3
3. Familiarizing Yourself with the System Components	5
3.1. HG-100K/LE Cameras	5
3.2. HG-TH Camera Heads and Camera Controller	7
3.3. Hub Sync Unit (HSU)	10
4. System Requirements	12
4.1. Minimum Package Contents	12
4.2. CCU and DCU System Requirements (including NIC)	12
4.3. Recommended DCU System Requirements	13
4.4. Operating System Requirements	13
4.5. Camera Network Requirements (multi-camera configurations)	13
4.6. System Power Requirements and Power Supply	14
4.7. Battery/Backup	15
4.8. Before Initial Use of the Backup Battery	15
4.9. Optics Lenses	15
4.10. HG-100K/LE Cable Options	16
4.11. HG-TH Cable Options	16
5. Hardware Setup	17
5.1. Single-Camera HG-100K/LE or Single HG-TH Controller System	17
5.2. Synchronized, Multiple HG-100K/LE Cameras or HG-TH Camera Controllers	19
5.3. Commercial Switch, Low-G System	21
5.4. Multi-Camera, Multi-HSU, Synchronized, High-G System	25
5.5. HG-100K/LE/TH Legacy Systems Interoperability	29
6. Software Installation and Configuration	30
7. Networking	31
7.1. One Camera Static IP System with a CCU	31
7.2. Multi-Camera Static IP System	32
7.3. One Camera DHCP System	33
7.4. Multi-Camera DHCP System	34
7.5. DCU Configuration	35
7.6. Legacy Cameras	37
7.7. Setting IP Address Parameters	38
8. Setting up Your Camera	40
8.1. Application Startup and Software Configuration	40
8.2. Set up Network Communications Performance	40
8.3. Interface Overview (Panels, Context Menus, Toolbar, Viewing Area)	43
8.4. Working with the Dockable Interface	46
8.5. Controlling Thumbnail Views	50

8.6.	Record Modes.....	52
8.7.	Sync In.....	52
8.8.	Resolution.....	53
8.9.	Exposure.....	53
8.10.	Session Length.....	53
8.11.	Session ID.....	54
8.12.	Frame Rate.....	54
8.13.	Trigger.....	55
8.14.	System Date and Time.....	58
8.15.	Time Source.....	58
8.16.	Strobe.....	59
8.17.	Border Data Setup.....	60
9.	Viewing a Live Image.....	61
9.1.	Open a Live View Window.....	61
9.2.	Display Control Options.....	62
9.3.	Viewing a Live Image on an NTSC/PAL Monitor with the HG-TH System.....	65
10.	Recording an Event.....	69
10.1.	Overview.....	69
10.2.	Record Controls.....	69
11.	Downloading, Opening and Saving Image Files.....	70
11.1.	Select File Format (Raw, AVI, etc.).....	70
11.2.	Save Border Data to XML.....	70
11.3.	Download and Create AVI Formatted File.....	70
11.4.	Create a File Name and Save to a Directory.....	70
11.5.	Select a Frame Range to Download.....	71
11.6.	File Download.....	71
11.7.	Open a Downloaded File.....	71
11.8.	Convert *.JPG, *.TIFF and *.TY2 images to *.AVI.....	72
12.	Playback.....	73
12.1.	Overview.....	73
12.2.	Open an Image for Playback.....	73
12.3.	Set Display Controls.....	74
12.4.	Set Frame Position.....	74
12.5.	Change the Frame Rate.....	74
12.6.	Set the Number of Frames to Skip when Advancing Frames.....	74
12.7.	Select Start and End Boundaries.....	74
12.8.	Set Camera Orientation.....	74
12.9.	Copy an Image.....	75
12.10.	Control Border Data Menu Display from the Context Menu.....	75
12.11.	Rotate the Image.....	75
12.12.	Toggle Between Live Image and Reference Image.....	75
12.13.	Set the Toggle Rate between Live and Reference Images.....	75
12.14.	Viewing a Playback Image on an NTSC/PAL Monitor with the HG-TH System.....	77
13.	Legacy Cameras.....	79
13.1.	HG/CR/TX Operation.....	79
13.2.	HG/CR/TX White Balance.....	80
13.3.	Activate the Reticle.....	80
13.4.	HG/CR/TX Playback.....	81
13.5.	PCMCIA File System.....	82
14.	Appendix A Camera Specifications.....	84
14.1.	Description.....	84
14.2.	Frame Rate/Resolution.....	84
14.3.	Frame Storage Capacity.....	86

14.4.	HG-100K Camera Specifications.....	87
14.5.	HG-100K Camera Sensor Specifications	88
14.6.	HG-LE Camera Specifications	89
14.7.	HG-LE Sensor Specification	90
14.8.	HG-TH Camera Specifications.....	91
14.9.	HG-TH Sensor Specification.....	92
14.10.	HG-100K/LE Camera Dimensions and Mounting Instructions.....	93
14.11.	HG-TH Camera Controller Dimensions and Mounting Holes	94
14.12.	HG-TH Camera Head Dimensions and Mounting Instructions.....	95
14.13.	HG-100K/LE Lithium Ion Battery Specifications.....	97
14.14.	HG-TH Lithium Ion Battery Specifications.....	97
15.	Appendix B Hub Sync Unit (HSU) Specifications	98
15.1.	HSU Specifications	98
15.2.	HSU Mounting Dimensions.....	99
15.3.	HSU and Synchronization.....	99
15.4.	HSU Legacy Port.....	100
15.5.	DCU Specifications.....	101
16.	Appendix C Connectivity/Connector Function	102
16.1.	Network Connectors	102
16.2.	HG-TH Composite Video Output BNC	102
16.3.	Configurable Connector	102
16.4.	Trigger Input Connector.....	103
16.5.	Strobe Output Connector	105
	Appendix D Image File Formats.....	106
17.	Appendix E Maintenance, Technical Support, Warranty	108
17.1.	Maintenance.....	108
17.2.	Technical Support	109
17.3.	Warranty.....	110
18.	Appendix F Troubleshooting	111
18.1.	About Box	111
18.2.	Side Effect Alerts.....	112
19.	Appendix G Formulas.....	113
19.1.	Session Length.....	113
19.2.	Frame Rates	114
19.3.	External Sync Exposure Timing	116
19.4.	Exposure Time	117
19.5.	Strobe Output Timing (with internal frame rate generator).....	118
19.6.	Hardware Trigger Delay through Hubs	119
20.	Appendix H Cable Specifications	120
20.1.	Camera Power Pigtail	120
20.2.	HSU Power Cable	120
20.3.	STP Cable Lengths and Timing.....	120
20.4.	Ethernet Communications Cable.....	121
20.5.	HG-TH Tethered Head Cables.....	121
21.	Appendix I Upgrade Camera Using the Upgrade Wizard	122
21.1.	HG-100K/LE Camera Upgrade	122
21.2.	HG-TH Camera Head and Camera Controller Upgrade	122
22.	Appendix J Glossary	123

1. Introduction

1.1. System Overview

The *MotionXtra* HG-100K/LE/TH system is a digital imaging system, designed to operate in the most challenging and rugged environments.

This section will introduce you to the system level concepts of the HG-100K/LE/TH digital imaging system.

For more information, see [Familiarizing Yourself with the System Components](#), page 5.

The *MotionXtra* HG-100K/LE/TH system consists of the following major components:

- HG-100K/LE camera
- [MotionCentral control software](#)
- [Camera Control Unit \(CCU\)](#)
- [Hub Sync Unit \(HSU\)](#)
- [Display Control Unit \(DCU\)](#)
- [Camera Controller \(HG-TH model only\)](#)
- Camera Heads (HG-TH model only)

1.1.1. MotionXtra HG-100K System

The HG-100K is a rugged, high-resolution, high-speed camera designed to withstand harsh environments. A [1000Base-T](#) Ethernet interface allows remote camera control and fast image transfer. A small backup battery is included within the camera to preserve the recording should a power failure occur after the event. The HG-100K model features an exclusive 1.7 megapixel CMOS sensor, and is capable of recording 1,000 [fps](#) at 1504 x 1128 pixel resolution and up to 100,000 fps at smaller resolutions.

1.1.2. MotionXtra HG-LE System

Built on the same great design and extensive features of the industry leading HG-100K, the HG-LE is an economical variant using one-half the sensor resolution and one-half the memory. The HG-LE offers mid-range frame rates and resolution at an affordable price. Its setup and operation are identical to the HG-100K.

1.1.3. HG-TH Camera System

The HG-TH is a tethered-head design that offers significant versatility with small, lightweight High-G Camera Heads that fit into confined spaces. The Camera Controller is also High-G and is available in several models that support one to four Camera Heads and from 2 [GB](#) to 8 GB of memory.

1.1.4. MotionCentral Camera Control Software

MotionCentral control software is a Microsoft Windows-based application designed to allow the user to set up and control one or more networked HG-100K/LE/TH and [legacy](#)* imagers concurrently. It provides the ability to view live images from the camera for set up, as well as play back images from the camera or computer hard drive. *MotionCentral* offers ease of use with an intuitive user-interface, and supports the conversion and storage of images in several file types.

* The term “legacy” as it is used in this manual, refers to earlier Redlake Imagers (ex. HG/CR/HG-TX)

1.1.5. Camera Control Unit

The Camera Control Unit (CCU) is a user-supplied [PC](#) with *MotionCentral* control software installed. With proper network configuration, the CCU can also provide a communication link from the discrete camera network to a user's network backbone for file transfer. Install additional CCUs within the same discrete network to enable remote viewing and control of the cameras.

Note: The Camera Control Unit (CCU) is a user-supplied PC.

1.1.6. DCU (Display Control Unit)

The DCU (Display Control Unit) is a portable PC or Tablet PC used primarily for setting up the cameras, including framing field of view, focusing and setting the f-stop. Connect it directly to a camera, HSU or networked hub. The DCU runs the same *MotionCentral* software as the CCU so it is fully capable of all camera control functions.

1.1.7. Hub Sync Unit

The HSU (Hub Sync Unit) is an eight-port network switch ideal for use in [High-G](#) environments. It supports the networking of multiple HG-100K/LE/TH imagers as well as connectivity to Legacy imagers through J-Boxes and D-Boxes. The HSU provides a precision clock for frame and trigger synchronization of multiple HG-100K/LE/TH imagers. The HSU also provides power to connected cameras.

2. Practical Applications

This section will describe how the HG-100K/LE/TH integrates into typical applications. The HG-100K/LE/TH provides high-resolution imaging at very high frame rates for use in many different industries. While specific requirements may vary from application to application, the HG-100K/LE/TH provides the flexibility necessary to meet the requirements for integration into data acquisition, analysis and testing systems used in such applications as:

- Vehicle impact testing
- Range, aerospace and ballistics
- Research, design and test

2.1. Vehicle Impact Testing

In applications like Vehicle Impact Crash Tests, the ability to reliably record and synchronize data is critical for accurate analysis of the event.

Cameras and sensors mounted on the car record the movements of the crash test dummies, air bags, and other components of interest. The HG-100K/LE/TH accurately records the entire event. The synchronization capabilities of the HG-100K/LE/TH allow for precise correlation of the images to the data collected from the sensors for thorough crash analysis.



2.1.1. Automobile Airbag Deployment

The HG-100K/LE/TH System provides the high-resolution and high-speed imaging sequences necessary to perform complex 3D analysis of such instantaneous events as the deployment of an automobile airbag on impact.

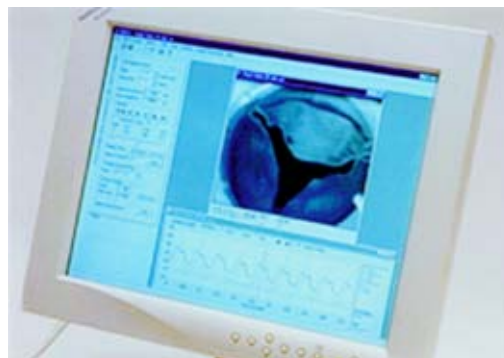
The HG-100K/LE/TH imaging system's compatibility with third party data acquisition and analysis software provides the ability to analyze the deployment of airbags on a frame-by-frame basis. Operating on data from a single camera can provide two dimensional motion data, and pulling image sequences from multiple cameras can provide true 3D motion analysis.

Analysis begins by processing the image sequence to determine the airbag shape in each frame. The system projects the exact shape of the airbag in 3D at every instant during inflation and deflation by correlating the data from several cameras, using specific markers.



2.1.2. Research, Design and Test

Research, design and test applications found in university and corporate laboratory environments require the use of high-speed and high-resolution image systems to test the design, function and performance of devices such as artificial heart valves. High-speed imagers like the HG-100K/LE/TH are crucial to the development process because they allow scientists to slow the motion of the device in action to view and evaluate any defects in design or function.



2.1.3. Range, Aerospace and Ballistics

Because of the high resolution and high speed of Redlake cameras, they have been used for years in applications such as weapons impact testing, space vehicle/missile launch, aircraft component performance verification and high-speed weapon performance and terminal ballistics.

In order to get multiple views of such events, multiple cameras are often positioned several hundred meters or even kilometers apart, making synchronization very difficult. To overcome the issues of synchronization over vast distances, the CCU has an [IRIG/GPS](#) board capable of sending and receiving IRIG clock signals to synchronize cameras.



3. Familiarizing Yourself with the System Components

3.1. HG-100K/LE Cameras



Figure 1: HG-100K camera side view



Figure 2: HG-LE camera side view

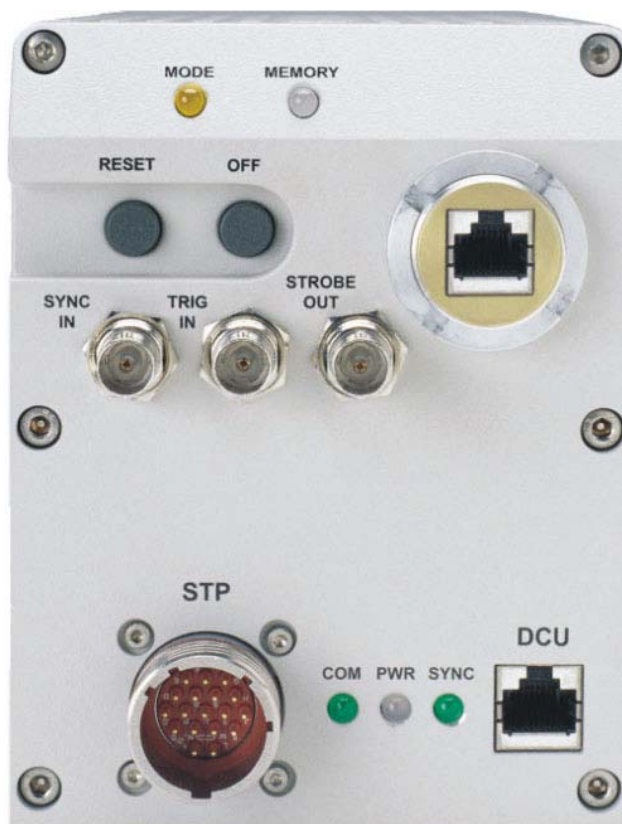


Figure 3: HG-100K/LE back panel

3.1.1. HG-100K/LE Connectors and LEDs

MODE LED indicator—if the MODE LED is off, it indicates that the camera is in Live or Standby mode. If the yellow LED is blinking, that indicates that the camera is in Record mode. A steady yellow light indicates that the camera has been triggered.

MEMORY LED indicator— a steady Red light indicates that the camera contains images that have not yet been accessed. A blinking green LED indicates that the camera is either playing or downloading an image from memory. A yellow LED indicates that there are captured images in memory that have been accessed. If the yellow LED is OFF, that indicates that there is memory available.

Reset Camera “warm boot” button—resets the camera’s microcontroller. The camera will retain its configuration settings set by the CCU and images in memory (resolution, frame rate, exposure, etc.).

OFF (Battery off) button—turns the battery power off, not the power, from the main source. The OFF button deletes the images currently in the memory when the camera is on battery power.

1000Base-T Camera LAN connector—is a ruggedized RJ-45 connector for 100/1000Base-T communications between the camera and the CCU.

Sync In connector—connect an external device for synchronizing the camera.

Trig In connector—connects an external device for triggering the camera.

Strobe Out connector— generates pulses that synchronize the timing of a strobe (or other peripheral device) with the camera’s exposure.

100Base-TX DCU connector— is a standard RJ-45 connector for 100Base-TX communication with the DCU. The primary function of the 100Base-TX is image display during focus and set up of the camera. This connector is not High-G rated and is not intended for use during High-G events.

STP (Synchronization/Timing/Power) connector—connects cameras to hubs, and hubs to hubs. For more information, see [Synchronization/Timing/Power Cable \(STP\)](#), page 121.

COM LED indicator—a steady green LED indicates that the camera is connected to the system. A blinking green light indicates that the camera is transmitting or receiving information.

POWER LED indicator—a green light indicates that power is ON and the battery is fully charged. A red LED indicates that the camera has lost power and is using the battery backup system to preserve image data in memory. A green light with intermittent flashing yellow indicates that power is on, but the battery is not fully charged.

SYNC LED indicator—a green LED indicates that there is a Sync signal present. If the green LED is off, there is no Sync signal present.

3.2. HG-TH Camera Heads and Camera Controller



Figure 4: HG-TH Camera Head front view



Figure 5: HG-TH Camera Head top view

3.2.1. HG-TH Camera Head LEDs and Connectors

MODE LED indicator—if the MODE LED is off, indicates the camera is in Live, or Standby mode. If the yellow LED is blinking, that indicates the camera is in Record mode. A steady yellow light indicates that the camera has been triggered.

POWER LED indicator—a green light indicates the camera is ready for operation. A yellow LED indicates the power is on.

SYNC LED indicator—if the SYNC LED is on, a Sync signal is present and sourced from the Root Hub. The LED flashes when Sync is present but the Root Hub is not present.

Camera Head Connector—provides a connection from the Camera Head to the Camera Controller via the Tethered Head cable.



Figure 6: HG-TH Camera Controller

3.2.2. HG-TH Camera Controller LEDs and Connectors

1000Base-T Camera LAN connector—is a ruggedized RJ-45 connector for 100/1000Base-T communications between the camera and the CCU.

COM LED indicator—a steady green LED indicates that the camera is connected to the system. A blinking green light indicates that the camera is transmitting or receiving information.

Reset Camera “Warm boot” button—resets the camera’s microcontroller. The camera will retain its configuration settings set by the CCU and images in memory (resolution, frame rate, exposure, etc.).

Head Select button—turns the output to the NTSC/PAL monitor ON/OFF. In multi-camera head configurations, it switches the output to the next camera on the Camera LAN.

OFF (Battery off) button—turns the battery power off, not the power, from the main source. The OFF button deletes the images currently in the memory when the camera is on battery power.

POWER LED indicator—a green light indicates that power is on the battery is fully charged. A red LED indicates that the camera has lost power and is using the battery backup system to preserve image data in memory. A green light with intermittent flashing yellow indicates that power is ON, but that the battery is not fully charged.

MODE LED indicator—if the MODE LED is off, it indicates that the camera is in Live or Standby mode. If the yellow LED is blinking, it indicates that the camera is in Record mode. A steady yellow light indicates that the camera has been triggered.

MEMORY LED indicator— a steady Red light indicates the camera contains images that have not yet been accessed. A blinking green LED indicates the camera is either playing or downloading an image from memory. A yellow LED indicates there are captured images in memory that have been accessed. If the yellow LED is OFF, it indicates that there is memory available.

100Base-TX DCU connector—is a standard RJ-45 connector for 100Base-TX communication with the DCU. The primary function of the 100Base-TX is image display during focus and set up of the camera. This connector is not High-G rated and is not intended for use during High-G events.

Sync In connector— connects an external device for synchronizing the camera.

Composite Out BNC—connects an NTSC/Pal monitor.

Trig In connector— connects an external device for triggering the camera.

SYNC LED indicator—a green LED indicates that there is a Sync signal present. If the green LED is off, there is no Sync signal present.

Camera Head connectors—connects the Camera Heads to the Camera Controller via the Tethered Head cable

HD-1, -2, -3, -4 LED indicators—indicates that the Camera Heads are connected to the camera LAN

STP (Synchronization/Timing/Power) connector—connects cameras to hubs, and hubs to hubs. For more information, see [Synchronization/Timing/Power Cable \(STP\)](#), page [121](#).

3.3. Hub Sync Unit (HSU)

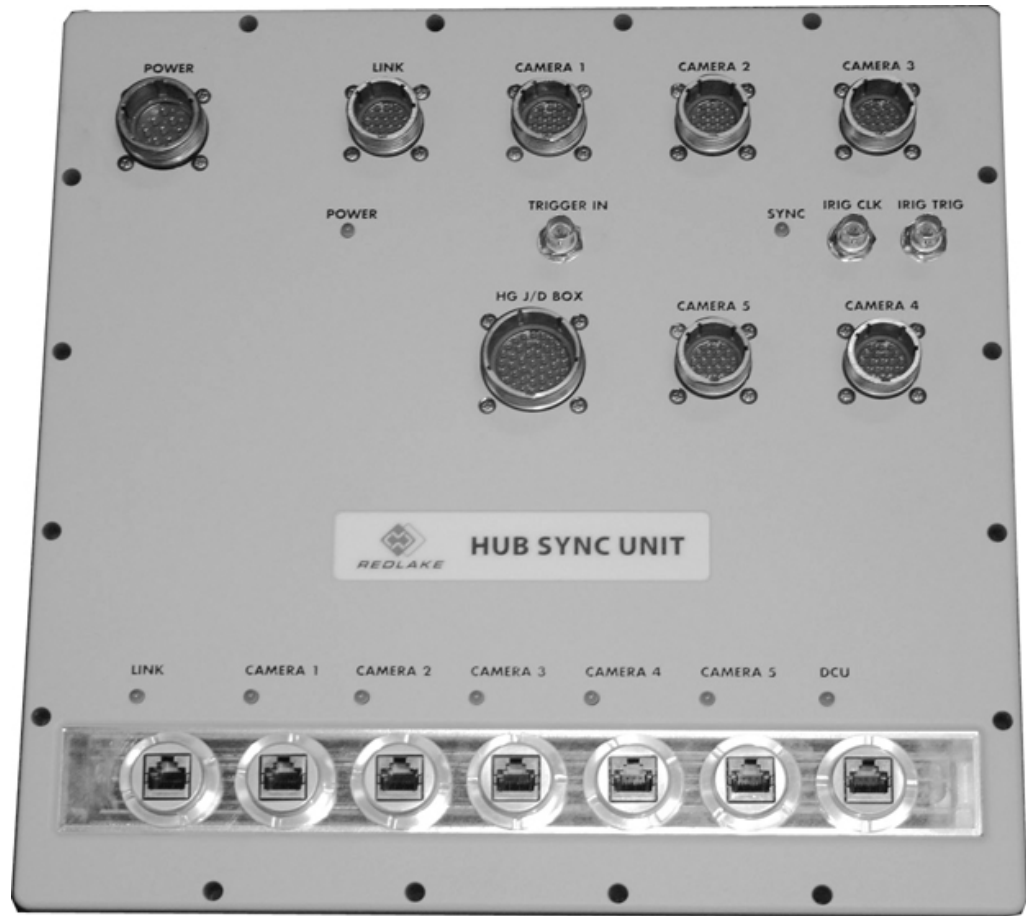


Figure 7: Hub Sync Unit (HSU)

3.3.1. HSU LEDs and Connectors

Power Connector—connects the HSU to the power source. Each HSU in a multi-HSU network requires a separate power source.

Link Connector—connects one HSU to another in a daisy chain configuration for multi-HSU LAN configurations. Use the Link Connector to establish an HSU as a Root Hub by Installing the Root Hub Cap on the Link Connector.

Camera 1-5 Connectors—STP (Sync/Trigger Return/Power) cable connects HG-100K/LE cameras or HG-TH Camera Controllers in a camera LAN. For more information, see [STP Cable Lengths and Timing](#), page 120.

Connection/Transmission LEDs—located above the Camera 1-5 Connectors, these LEDs will blink when transmitting data. A solid green light indicates there an established link to the associated device.

POWER LED— a green light indicates that power is ON.

Trigger In— connects an external device for triggering the camera.

SYNC LED— a green LED indicates there is a Sync signal present or the installation of a Root Hub Cap. A blinking light indicates the HSU is locked onto an incoming signal but the “root bit” is absent from the signal. If the green LED is off, there is no Sync signal present.

HD J/D Box—connects a J or D Box for connecting legacy cameras such as the HG-TX.

Link Connector—connects a daisy-chained HSU

DCU Connector—connects a DCU to the camera LAN for setting up and configuring the cameras.

4. System Requirements

4.1. Minimum Package Contents

HG-100K/LE	HG-TH
HG-100K/LE camera(s)	HG-TH Camera Heads and cables
<i>MotionCentral</i> software CD with user's manual	Camera Controller
C-mount and F-mount lens adapters	<i>MotionCentral</i> software CD with user's manual
Power pigtail	C-mount lens adapter
10m rugged Ethernet cable	Power pigtail
	10m rugged Ethernet cable

4.2. CCU and DCU System Requirements (including NIC)

The HG-100K/LE/TH system is capable of displaying, processing, and downloading vast amounts of video data. The following are recommendations for running the *MotionCentral* control software on a CCU controlling a multi-camera imaging network.

CCU's controlling Networks of up to 3 cameras	CCU's controlling Networks of more than 3 cameras
2.4 GHz Intel® Pentium 4 Processor	Dual 2.4 GHz Intel® Xeon Processors
512 MB of RAM	2 GB of RAM
Gforce4 128 MB AGP Graphics Controller (or equivalent)	Gforce4 128 MB AGP Graphics Controller (or equivalent)
(1) 3COM 3C996B-T 1000Base-T Ethernet Card (or equivalent)	(2) 3COM 3C996B-T Gigabit Ethernet Card (or equivalent)
Keyboard and Mouse	Keyboard and Mouse
21" Color Monitor, with 1600 x1200 resolution*	21" Color Monitor, with 1600 x1200 resolution*
40 GB Hard Disk Drive	80 GB Hard Disk Drive

*An SVGA monitor capable of 1600 x1200 resolution is recommended to take advantage of the camera's full resolution, but resolutions of 1280 x 1024, 1024 x 768, will also be supported to accommodate a wider range of monitors and video cards.)

4.3. Recommended DCU System Requirements

The DCU runs the same *MotionCentral* software as the CCU, and is capable of displaying, processing and downloading video data. The DCU is for set up of individual cameras only and not for downloading vast amounts of image data, therefore, the following recommendation is for running the *MotionCentral* control software on a DCU.

Recommended System Requirements
Intel® III processor 800 MHz
256 MB of RAM
Integrated Intel® Direct AGP graphics with 8 MB Dynamic Video Memory Technology
10/100 Base-TX Ethernet port
20 GB Hard Disk Drive
Recommended Resolution on the DCU 1024 x 768

4.4. Operating System Requirements

The CCU or DCU must be running either Windows™ XP, Windows 2000 Pro (SP2) or higher, or Windows NT4.0 (SP 6.0a) or higher.

4.5. Camera Network Requirements (multi-camera configurations)

Multi-camera configurations require either a Redlake HSU or a commercial networking switch to create a Camera LAN. If you are using a commercial networking switch use a Gigabit 100Base-T or 1000Base-T Ethernet switch for the best download performance.

4.5.1. NIC (Network Interface Controller)

Connect the CCU to the Camera [LAN](#) using a 1000Base-T Ethernet NIC in a fan-out tree configuration. The system supports [100Base-TX](#), but offers less performance for downloading a large numbers of TIFF and [Type-2](#) images. If the PC does not already have one installed, begin by installing a 1000Base-T network interface controller ([NIC](#)) in the CCU computer. Follow the NIC manufacturer's instructions for installation.

A DCU requires either a 100Base-TX or 1000Base-T Ethernet NIC. Follow the NIC manufacturer's instructions for installation.

4.6. System Power Requirements and Power Supply

The STP connector provides power to the cameras and Camera Controllers. Use either a Power Pigtail, pre-wired power supply or an STP cable connected to an HSU to supply power to the camera or Camera Controller. The cameras and Camera Controllers require a minimum of 24 volts.

4.6.1. Using the Power Pigtail

- Apply 24 to 50 volts DC to the Power Pigtail connections.
- Confirm correct wiring. Refer to, [Camera Power Pigtail](#), page 120.
- Apply power and return (ground) to all of the connection listed for power (+) and power return (-).

For related information see [Hardware Setup](#), page 17.

4.6.2. Power Requirements

Refer to the Camera Power Requirements Table and the HSU Power Requirements Table when configuring a Camera LAN. Refer to the power supply rating and confirm sufficient output for the configuration. An HSU is limited to the number of cameras or Camera Controllers it can support by the total power available through the HSU.

4.6.3. Camera Power Requirements Table

Camera	Power Requirements in Watts
HG-100K/LE camera (using any power configuration)	40
Two port HG-TH Camera Controller 1 Camera Head attached	35
Two port HG-TH Camera Controller 2 Camera Heads attached	45
Four port HG-TH Camera Controller 1 Camera Head attached	45
Four port HG-TH Camera Controller 2 Camera Heads attached	60
Four port HG-TH Camera Controller 3 Camera Heads attached	75
Four port HG-TH Camera Controller 4 Camera Heads attached*	90

*The maximum output of an STP connector on the HSU is not sufficient to power an HG-TH Camera Controller with four Camera Heads. Call your Redlake dealer for information regarding an HSU power update.

4.6.4. HSU Power Requirements Table

Calculate the total power required by all cameras and the HSU to select a power source with sufficient capacity. The voltage input to the HSU determines the total power available to distribute to the cameras and Camera Controllers.

HSU Voltage Input	20 to 24	25 to 32	33 to 50
Total Watts Available	200	225	300
Maximum Watts per STP output	80	80	80

4.6.5. Power Management

The HG-100K/LE/TH system has four power management modes.

Normal—the sensor is active (power required 40.5W).

Low-Power Mode (Standby)—the sensor is inactive (power required 13.5W).

Battery Backup—initiated at loss of DC power. Battery backup retains captured images stored in memory for approximately six hours under normal operating conditions.

Off—everything is off, including the image SDRAM.

4.6.6. Power Modes

When the *MotionCentral* retrieves a Thumbnail for display from the Camera List window the sensor is active for 30 seconds, then it will drop into Low-Power mode. When the camera has images stored in its memory, it goes into Low-power mode and the sensor is not active. If the Thumbnail is set to show a Live thumbnail view, the sensor remains active until it is turned off, or a Live View Window is opened.

4.7. Battery/Backup

The HG-100K/LE/TH has a 3.6 V Lithium Ion battery backup to allow for retaining and recovering images during a power fault for approximately six hours under normal operating conditions.

4.8. Before Initial Use of the Backup Battery

To ensure the best performance of the backup Lithium Ion battery, follow these directions before initial use and after long periods of inactivity.

1. Charge the battery fully. (POWER LED will be solid green.)
2. Allow the battery to fully discharge by unplugging the camera from its power source and leaving the camera ON with only battery backup power. (POWER LED will be solid red.)
3. Charge the battery. (POWER LED will alternate from green to amber until fully charged.)

4.9. Optics Lenses

The HG-100K ships with Nikon F-mount and C-mount lens adapters. The HG-LE and HG-TH ship with C-mount lens adapters.

HG-100K/LE High-G applications, two Box-Mount lens adapters are available:

- 20007036-001 Flange Focal Distance = 45.6 mm
- 20007036-002 Flange Focal Distance = 50.4 mm

HG-TH High-G applications, Box-Mount lens adapters are available:

- 10000667-002 Flange Focal Distances = 45.6 mm and 50.4 mm

Box-Mount adapters ship with a set of shims of varying thickness to accommodate various High-G lenses. In addition, the camera front has a machined surface to mount High-G lenses directly.

4.10. HG-100K/LE Cable Options

- 30007000-001, 5m STP Cable
- 30007000-002, 10m STP Cable
- 30007000-003, 25m STP Cable
- 30007000-005, 50m STP Cable
- 30007000-006, 75m STP Cable
- 30007000-004, 100m STP Cable
- 10007029-001, STP Connector for Customer-built cables
- 30007002-002, 10 m Rugged Ethernet Communication Cable
- 30007002-003, 25m Rugged Ethernet Communication Cable
- 30007002-005, 50m Rugged Ethernet Communication Cable
- 30007002-006, 75m Rugged Ethernet Communication Cable
- 30007002-004, 100m Rugged Ethernet Communication Cable

4.11. HG-TH Cable Options

- 30007084-001, Trigger/Sync In Cable, OB Series, LEMO, 3 m, FGG-08-302-CLCD31
- 30007083-001, Sync/Strobe Out Cable, 00 Series, LEMO, 3 m, FGG-00-302-CLAD30
- 30007001-001, STP Sync/Trigger/Power Pigtail cable, 2 m
- 30007002-002, 10 m Rugged Ethernet Communication Cable
- 30007002-003, 25m Rugged Ethernet Communication Cable
- 30007002-005, 50m Rugged Ethernet Communication Cable
- 30007002-006, 75m Rugged Ethernet Communication Cable
- 30007002-004, 100m Rugged Ethernet Communication Cable
- For cable lengths longer than 100 m, contact <http://www.omnitron-systems.com> for copper to fiber converters.

5. Hardware Setup

The HG-100K/LE/TH system is scalable and provides remote connectivity using standard off-the-shelf network components. The following section provides a basic overview of the scalability of the HG-100K/LE/TH system, along with integration and interoperability of legacy cameras.

5.1. Single-Camera HG-100K/LE or Single HG-TH Controller System

For applications in low-impact environments requiring images from one vantage point, it is simple and convenient to implement a basic HG-100K/LE system using one HG-100K/LE camera and a CCU running the *MotionCentral* control software. The HG-TH system provides a similar setup option using multiple HG-TH Camera Heads, an HG-TH Camera Controller and a CCU.

5.1.1. Connect a Single HG-100K/LE Camera to a CCU/DCU

In a basic configuration using a single HG-100K/LE camera, connect the camera directly to the computer's Ethernet port using an Ethernet cable (Cat5E or Cat6 cable). Redlake provides an Ethernet cable with an integrated retaining ring designed to lock the connector in place during High-G events.

1. Connect the camera to the power source. Once the camera receives power, the MODE LED will blink and then go out. The POWER LED will be ON, solid green.
2. Connect one end of the Ethernet cable to the 1000Base-T Camera LAN or the 100Base-T DCU connector on the camera, and the other end to the Ethernet port on the CCU/DCU. Once connected to the camera LAN, the COM LED will be lit solid green, indicating network connectivity, and will blink when there is activity over the network.

For more information on setting up the camera LAN, see [Networking](#), page 31.

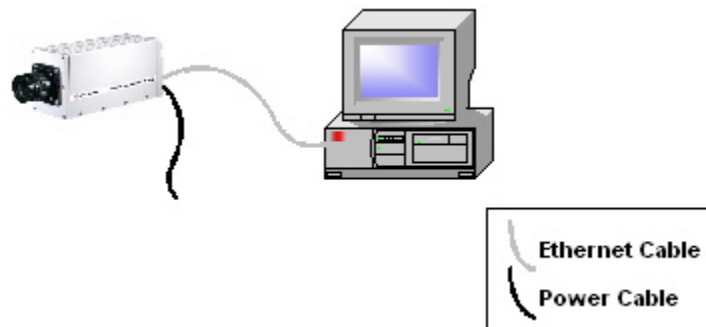


Figure 8: HG-100K/LE connected via Ethernet to a CCU

5.1.2. Connect a HG-TH Camera Controller to a CCU/DCU

In a basic configuration using multiple Camera Heads, connect the Camera Controller directly to the computer's Ethernet port using an Ethernet cable (Cat5E or Cat6 cable). Redlake provides an Ethernet cable with an integrated retaining ring designed to lock the connector in place during High-G events.

1. Connect the camera cable(s) to the Camera Head(s). Connect the other end(s) to the Camera Head port(s) on the Camera Controller.
2. Connect the Camera Controller to the power source. The COM LED will be lit solid green when the camera receives power.
3. Connect one end of the Ethernet cable to the 1000Base-T Camera LAN or the 100Base-T DCU connector on the Camera Controller, and the other end to the Ethernet port on the CCU/DCU. Once connected to the Camera LAN, the COM LED will be lit solid green, indicating network connectivity, and will blink when there is activity over the network.

Note: There is no required sequence for connecting the power or Ethernet cables to the camera. They can be connected in any order.

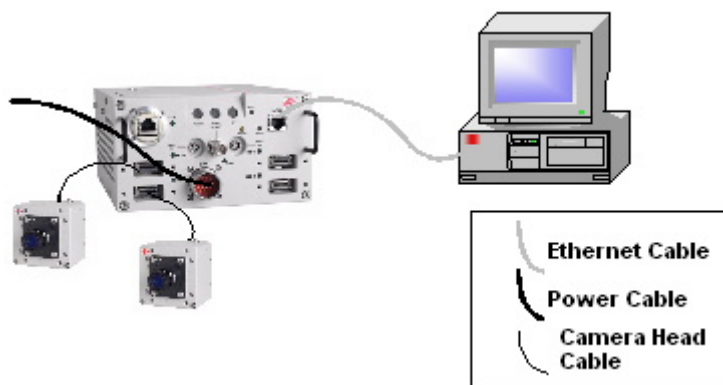


Figure 9: HG-TH Controller with two Camera Heads connected via Ethernet cable

5.2. Synchronized, Multiple HG-100K/LE Cameras or HG-TH Camera Controllers

Multiple HG-100K/LE cameras or HG-TH Camera Controllers with Camera Heads can be networked using the Redlake HSU (Hub Sync Unit) connected to the CCU.

In a system using the Redlake HSU, all cameras will have the same time stamp for frame 0 and will record each frame precisely in unison. The cameras can be triggered either through the software or by using a TTL pulse or switch closure to initiate frame acquisition.

The design concept of the HG-100K/LE/TH system allows for the use of multiple cameras, all synchronized by the root HSU to within ± 2.5 microseconds. The root HSU propagates trigger signals and control communications throughout the system. The system provides synchronized image data capture from several vantage points.

The root hub manages the distribution of synchronization and trigger signals to the cameras, hubs, and legacy boxes. This synchronizes all of the devices in the camera network to the root hub. The root hub is the HSU with a Root Hub Cap. The root hub originates a Sync signal with encoding for frame synchronization, time stamp and trigger.

If a HSU loses the root hub Sync signal, the Sync signal indicates loss of Sync with the root hub and each camera will tag its subsequent image files with a loss of Sync marker, which displays in the border data.

A hardware trigger can be received anywhere on the network. A trigger connected to the camera, Camera Controller or the hub, propagates back to the root hub via the Trigger Return signal for encoding onto the Sync signal.

For more information on setting up the camera LAN, see [Networking](#) , page [31](#)

For more information on the power requirements, see [System Power Requirements and Power Supply](#) page [14](#).

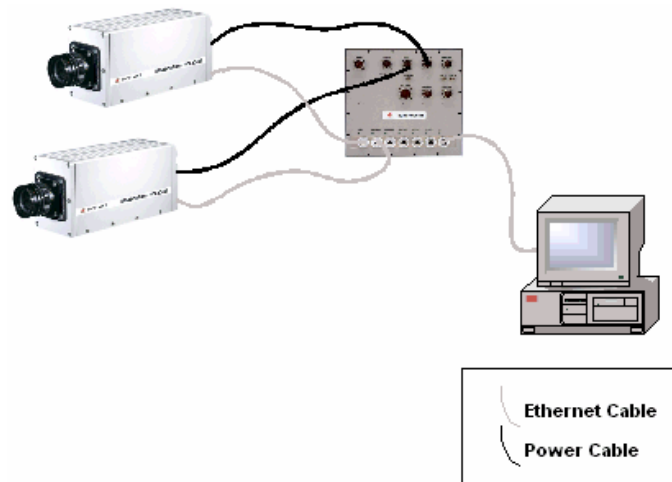


Figure 10: HG-100K/LE synchronized multi-camera system

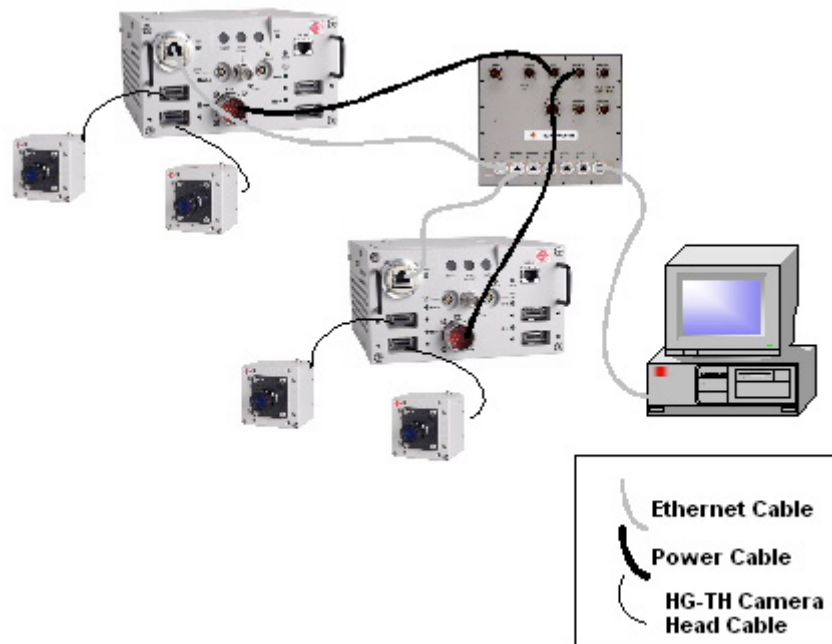


Figure 11: HG-TH synchronized multi-camera system

5.3. Commercial Switch, Low-G System

The HG-100K/LE/TH camera works in [Low-G](#) environments using a commercial, off-the-shelf 1000Base-T Ethernet switch. Commercial Ethernet switches do not provide the power pass-through available with the Redlake HSU; therefore, each camera requires a power source. The cameras can be triggered either through the software or by using a switch closure to initiate frame acquisition.

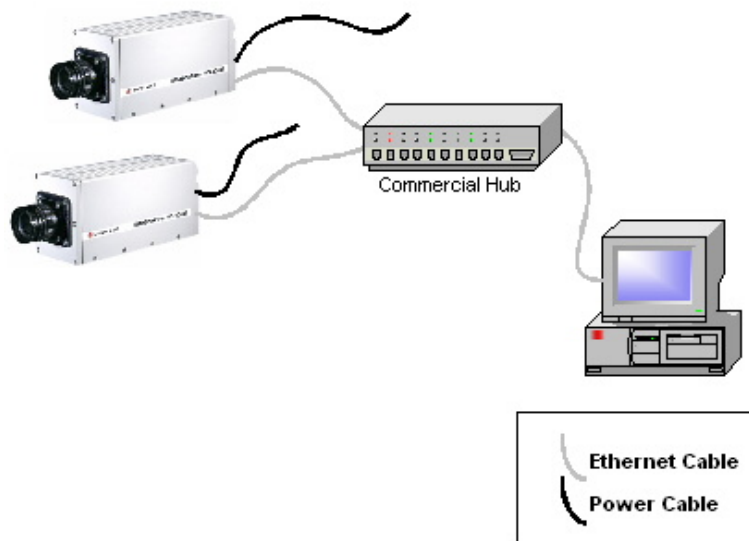


Figure 12: HG-100K/LE Low-G commercial switches system

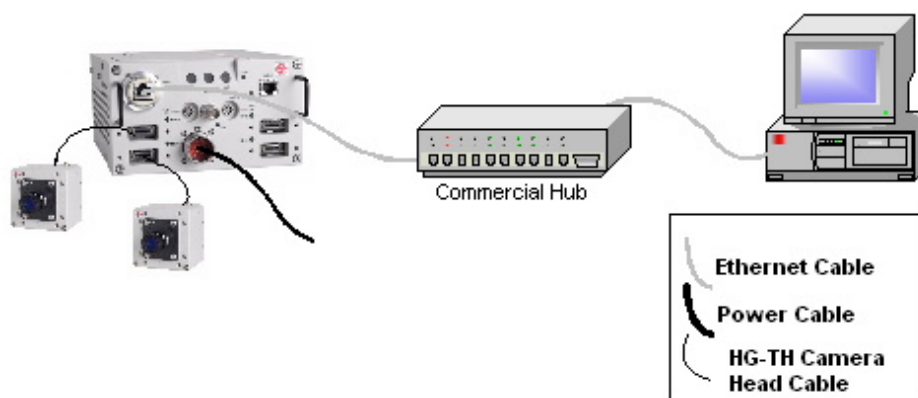


Figure 13: HG-TH low-G commercial switch system

5.3.1. Connect Multiple HG-100K/LE Cameras to an HSU or Ethernet Switch

For installations with multiple cameras, connect an HSU or Ethernet switch to the computer's Ethernet port. Use the appropriate connecting cables supplied with the camera hardware.

1. Connect a Root Hub Cap to the Link port, adjacent to the Power connector. Install in the same manner as any of the STP cable connectors, by aligning the keys on the connector and then twisting it into place until snug. This HSU is now the root HSU on the LAN.
2. Connect one end of an Ethernet cable to one of the Ethernet ports on the lower portion of the HSU or to the Ethernet port on the switch. Connect the other end of the cable to the Ethernet port of the CCU.
3. Connect the HSU to the power source. The HSU provides power to each of the cameras. Power requirements will vary depending on the number of cameras connected to the HSU.
4. Connect the power cables to each camera, and the other ends to the Camera Ports HSU. Once the cameras receive power from the HSU, the MODE LEDs will blink briefly then go out. The POWER LED will be solid green.
5. Connect one end of the Ethernet cable to the 1000Base-T Camera LAN connector on the cameras, and the other end to one of the camera Ethernet connectors on the HSU or Ethernet connectors on the switch. Once connected to the camera LAN, the camera COM LEDs will be lit solid green, indicating network connectivity, and will blink when there is activity over the network.



The SYNC LEDs on the cameras will be blink indicating that they are receiving the timing signal from the HSU. The SYNC LEDs on both the cameras and on the HSU will be solid green if a LAN recognizes an HSU as the root hub (has the Root Hub Cap installed).

For more information on setting up the camera LAN, see [Networking](#), page [31](#).

For more information on the power requirements, see [System Power Requirements and Power Supply](#), page [14](#).



Figure 14: HSU (Hub Sync Unit)

Note: The HG-100K/LE cameras and HSU allow “hot-swapping” and there is no particular order for connecting the cables. Legacy cameras are not hot swappable.

5.3.2. Connect Multiple HG-TH Camera Controllers to an HSU or Ethernet Switch

For installations with multiple cameras, connect an HSU or Ethernet switch to the computer's Ethernet port. The camera hardware includes appropriate connecting cables.

1. Connect a Root Hub Cap to the Link port on the HSU. Align the keys on the connector and twist into place until snug. This HSU is now the root HSU on the LAN.
2. Connect one end of an Ethernet cable to one of the Ethernet ports on the lower portion of the HSU or to an Ethernet port on the switch. Connect the other end of the cable to the Ethernet port of the CCU.
3. Connect the camera cables(s) to the Camera Heads(s). Connect the other end(s) to the Camera Head ports(s) on the Camera Controller.
4. Connect the HSU to the power source. The HSU provides power to each of the Camera Controllers.
5. Connect the power cables to the Camera Controller, and the other end to the HSU. Once the Camera Controllers receive power from the HSU, the MODE LEDs will blink briefly then go out. The POWER LED will be solid green.
6. Connect one end of the Ethernet cable to the 1000Base-T Camera LAN connector on the Camera Controller and the other end to one of the Camera Ethernet connectors on the HSU or switch. Once connected to the Camera LAN, the COM LEDs will be lit solid green, indicating network connectivity, and will blink when there is activity over the network.



The SYNC LEDs on the cameras will blink, indicating that they are receiving the timing signal from the HSU. The SYNC LEDs on both the cameras and on the HSU will be solid green if a LAN recognizes an HSU as the root hub (has the Root Hub Cap installed).

For more information on setting up the camera LAN, see [Networking](#), page [31](#).

For more information on the power requirements, see [System Power Requirements and Power Supply](#), page [14](#).

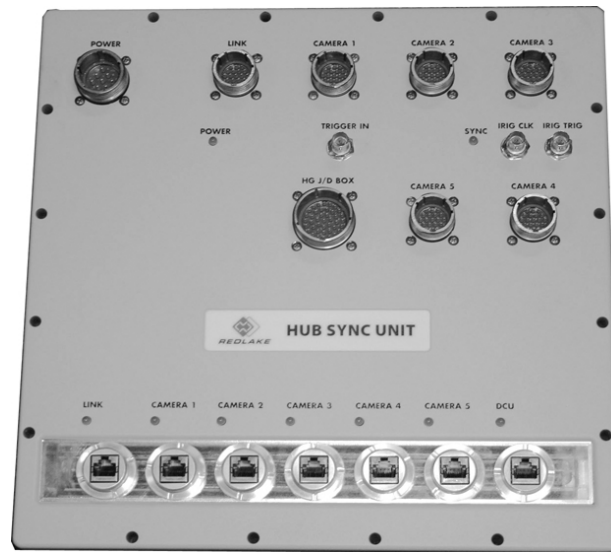


Figure 15: HSU (Hub Sync Unit)

Note: The HG-100K/LE/TH and HSU are designed to allow “hot-swapping” and there is no particular order for connecting the cables. Legacy cameras are not hot pluggable.

5.4. Multi-Camera, Multi-HSU, Synchronized, High-G System

The design concept of the HG-100K/LE/TH system allows the use of multiple High-G HSUs and cameras; all synchronized by the root HSU to within ± 2.5 microseconds. The root HSU connects to the CCU and propagates trigger signals and control communications throughout the system. This accurate synchronization and single-source control enables the capture of a single event from many vantage points, all controlled by a single installation of the *MotionCentral* software.

Each HSU is capable of providing power and synchronization for HG-100K/LE cameras and HG-TH Camera Controllers. It provides remote network connectivity to the cameras and to other HSUs.

When connecting more than one HSU, the HSU with a Root Hub Cap installed becomes the root hub. Connect the next hub on the network to one of the Link ports on the root hub.

The root hub manages the distribution of synchronization and trigger signals to the cameras, HSUs, and legacy boxes. This synchronizes all of the devices in the camera network to the root hub. The root hub originates a sync signal with encoding for frame synchronization, time stamping, and triggering of the camera array.

If a HSU loses the Root Hub Sync signal, the sync signal generated at the hub indicates loss of Sync with the root hub and each camera will tag its subsequent image files with a loss of Sync marker, which displays in the border data.

A hardware trigger can be received anywhere on the network, camera or HSU. A trigger connected to the camera or the hub, propagates back to the root hub via the trigger return signal for encoding onto the Sync signal.

NOTE: Before placing an HSU-powered camera network in Ready mode, connect and power **ALL** of the cameras in the network. Placing additional cameras on the network may inadvertently trigger the previously connected cameras.

Connect the cameras to the camera LAN and set up the software to recognize the cameras to control remotely the cameras' features using *MotionCentral* software.

For more information on setting up the Camera LAN, see [Networking](#), page 31.

For more information on the power requirements, see [System Power Requirements and Power Supply](#) page 14.

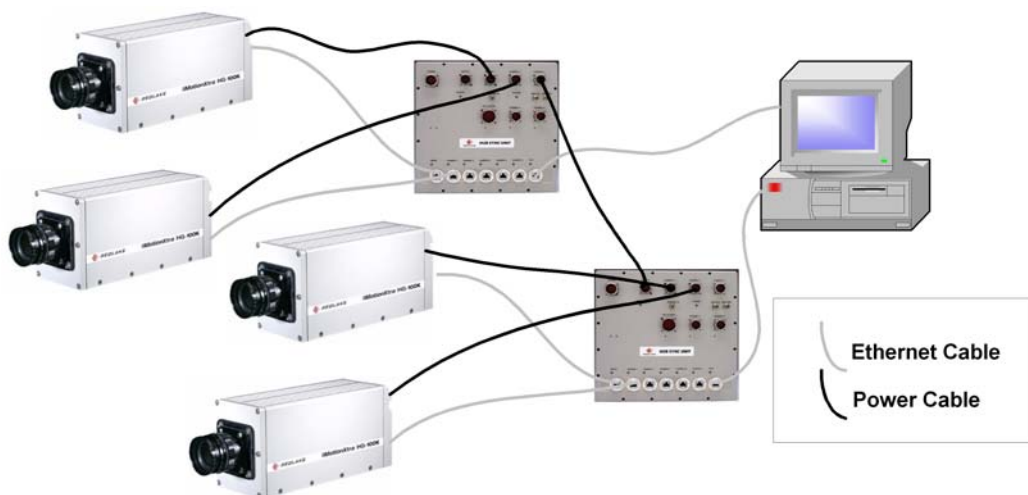


Figure 16: Multiple HSU, Multiple HG-100K/LE setup

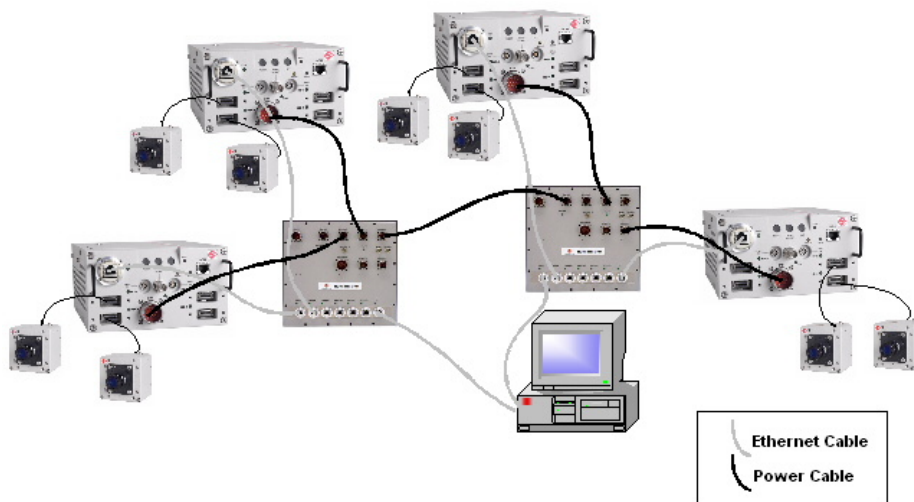


Figure 17: Multiple HSU, multiple HG-TH

5.4.1. Connect Multiple HG-100K/LE Cameras and Multiple HSUs

For installations with multiple cameras, connect an HSU or Ethernet switch directly to the computer's Ethernet port. The camera hardware includes appropriate connecting cables.

1. Connect a Root Hub Cap to the Link port of the HSU. Align the keys on the connector and then twist into place until snug. This HSU now be the root HSU on the LAN.
2. Connect an STP cable to one of the STP ports on the root HSU labeled Camera. Connect the other end to the STP port labeled Link on the second HSU. To daisy chain an additional HSU to the second HSU, connect the STP cable to an STP port labeled Camera on the second HSU. Connect the other end to the STP port labeled Link on the third HSU.
3. Connect one end of an Ethernet cable to one of the Ethernet ports on the lower portion of the root HSU. Connect the other end of the cable to the Ethernet port of the PC.
4. Connect the HSU to the power source. The HSU provides power to each of the cameras. Power requirements will vary depending on the number of cameras connected to the HSU.
5. Connect the power cables to each camera, and the other ends to the camera ports on the HSU. Once the cameras receive power from the HSU, the MODE LEDs will blink briefly then go out. The POWER LED will be solid green.
6. Connect one end of the Ethernet cable to the 1000Base-T Camera LAN connector on the cameras, and the other end to one of the camera Ethernet connectors on the HSU. Connect additional HSUs to the root hub HSU using the Link RJ45 ports. Once connected to the camera LAN, the camera COM LEDs will be lit solid green, indicating network connectivity, and will blink when there is activity over the network.

The Sync LEDs on the cameras will be blink indicating that they are receiving the timing signal from the HSU. If the LAN recognizes an HSU as the root hub (has the Root Hub Cap installed), the Sync LEDs on both the cameras and on the HSU will be solid green.

For more information on setting up the camera LAN, see [Networking](#) , page [31](#).

For more information on the power requirements, see [System Power Requirements and Power Supply](#) page [14](#).

5.4.2. Connect Multiple HG-TH Camera Controllers and HSUs

1. Connect a Root Hub Cap to the Link port on the HSU adjacent to the Power connector. Align the keys on the connector and then twist into place until snug. This HSU now be the root HSU on the LAN.
2. Connect an STP cable to one of the STP ports on the root HSU labeled Camera. Connect the other end to the STP port labeled Link on the second HSU. To daisy chain an additional HSU, connect the STP cable to an STP port labeled Camera on the second. Connect the other end to the STP port labeled Link on the third HSU.
3. Connect one end of an Ethernet cable to one of the Ethernet ports on the lower portion of the root HSU or to the Ethernet port on the switch. Connect the other end of the cable to the Ethernet port of the PC.
4. Connect the HSU to the power source. The HSU provides power to each of the Camera Controllers.
5. Connect the power cables to each Camera Controller, and the other ends to the Camera port on the HSU. Once the Camera Controllers receive power from the HSU, the MODE LEDs will blink briefly then go out. The POWER LED will be solid green.
6. Connect one end of the Ethernet cable to the 1000Base-T Camera LAN connector on the Camera Controller, and the other end to one of the camera Ethernet connectors on the HSU. Connect additional HSUs to the root hub using the RJ-45 port labeled Link. Once connected to the camera LAN, the COM LEDs will be lit solid green, indicating network connectivity, and will blink when there is activity over the network.



The SYNC LEDs on the cameras will blink, indicating that they are receiving the timing signal from the HSU. If the LAN recognizes an HSU as the root hub (has the Root Hub Cap installed), the SYNC LEDs on both the cameras and on the HSU will be solid green

For more information on setting up the camera LAN, see [Networking](#), page [31](#).

For more information on the power requirements, see [System Power Requirements and Power Supply](#), page [14](#).

5.5. HG-100K/LE/TH Legacy Systems Interoperability

The HG-100K/LE/TH system allows for a mix of HG-100K/LE/TH equipment and Legacy equipment such as the CR2000, HG2000 and HG-TX imagers.

The HSU has a legacy port to connect Legacy cameras to the HG-100K/LE/TH network via legacy junction boxes (J-Boxes) or distribution boxes (D-Boxes). This functionality allows the use of legacy equipment while upgrading to the HG-100K/LE/TH system. Connect the legacy hub (J-Box or D-Box) directly to the root HSU, triggering and synchronization of the legacy equipment is maintained.

The Legacy Communications cable is required to connect the D- and J-Boxes to the HSU. Attach it to the Output connector on the J- or D-Box and the other end to the J/D Box connector on the HSU. Camera commands, trigger, and sync (at 1000 fps) transfer over this communication/data link between the CCU and the legacy cameras.

The HSU does **NOT** provide power to legacy cameras and J/D boxes. The J/D boxes connect to their own power supplies.

A 1 KHz sync signal is active on the legacy port of the HSU. If legacy cameras are set to external mode when in record, they will receive a 1 KHz pulse that is frame synchronized with the HG-100K/LE/TH camera, regardless of HG-100K/LE/TH frame rate.

Note: A high-resolution RS170 monitor is necessary to perform the field of view and focus actions for legacy cameras.

For more information on setting up the camera LAN, see [Networking](#) , page [31](#)

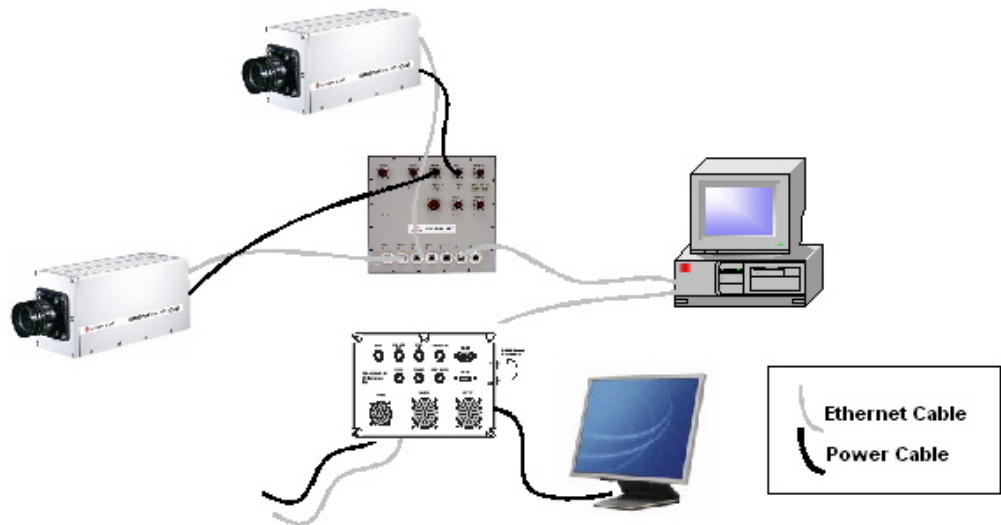


Figure 18: Legacy camera and HG-100K/LE camera setup

6. Software Installation and Configuration

The PC or tablet computer must be running a Windows operating system. *MotionCentral* is compatible with the following operating systems Windows 2000 Pro, Windows NT® 4.0 with the latest Microsoft updates and service packs.

Compatibility tests of *MotionCentral* with Windows XP reveal that *MotionCentral* is fully compatible with Windows XP Service Pack 2 when the Firewall component is disabled. Disable the Service Pack 2 Firewall by selecting the Windows Control Panel > Network Connections > Properties tab for the camera network connection. Consult your system administrator for further assistance and information regarding Windows XP Service Pack 2.

In addition, install Microsoft .NET runtime support before installing *MotionCentral*.

6.1.1. Install MotionCentral Software

1. Insert the distribution CD into the computer's CD-ROM drive. If the computer is set up for autorun the installer will run automatically. If not, select the *MotionCentral* directory and then double-click SETUP.EXE from the directory file list.
2. Select a path and the installer will place *MotionCentral*'s files in the appropriate locations.
3. Exit when installation is complete.

The setup program will solicit a pathname for the location of its files. The recommended default path is C:\Program Files\Redlake. Select another path if desired.

Important Note! If .NET runtime is not installed on the computer a prompt will display stating that .NET must be installed before *MotionCentral* can be installed.

6.1.2. .NET Runtime Installation

Install only if prompted by *MotionCentral*!

1. Insert the CD into the CD-ROM and open the Required Software folder. Double-click the file named DOTNETFX.EXE. This will launch the .NET installer.
2. Once the installation is complete, reboot the system.

6.1.3. Install MotionCentral on the DCU

MotionCentral software comes pre-installed on DCUs purchased from Redlake. If purchased separately, you will need to install *MotionCentral*. If the tablet computer you have selected to be your DCU has a CD-ROM drive, follow the *Install MotionCentral Software* Instructions above.

If the DCU does not have a CD-ROM drive, the files can be loaded and the software installed by connecting the DCU to a network and copying the files directly to the DCU.

7. Networking

7.1. One Camera Static IP System with a CCU

The HG-100K/LE/TH uses Ethernet and IP networking for communications between the different devices in the system. Networking with the camera takes place either through the 1000Base-T Camera LAN connector, or the 100Base-T DCU connector. The 1000Base-T operates at either 100 Mbps or 1000 Mbps, whereas the DCU Port operates at a fixed rate of 100 Mbps.

For proper operation of an IP network, the devices on the network must have unique IP addresses within the same subnet. These address assignments can be set statically by the system administrator or dynamically using a DHCP protocol.

In a one-camera Static IP system, the devices on the network are:

- HG-100K/LE camera or HG-TH Camera Controller
- CCU (PC with Gigabit NIC card)

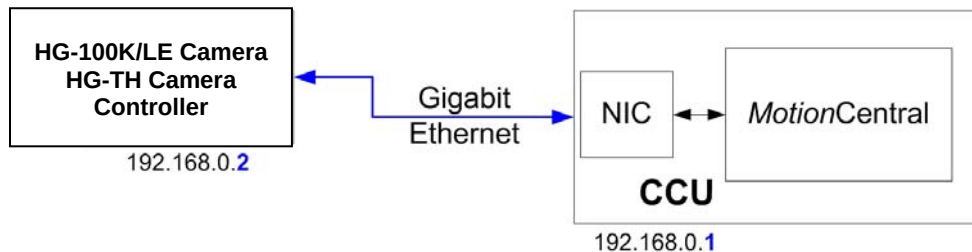


Figure 19: Single camera system using static IP addressing

Attach these devices with a single Ethernet cable using the camera's or camera controller's 1000Base-T Camera LAN connector and the Ethernet port of the CCU. The 1000Base-T connector on the camera and Camera Controller comes up at 100 Mbps and switches to 1000 Mbps when moving TIFF or Type-2 data. The NIC in the CCU must be capable of auto-negotiation between these two speeds.

The HG-100K/LE 1000Base-T port comes with a factory default IP address of 192.168.0.2 with its DHCP client turned OFF (set for static addressing). The HG-TH Camera Controller's Camera Head ports come with a factory default IP address of 192.168.0.2, 192.168.0.3, 192.168.0.4, 192.168.0.5, with the DHCP clients turned OFF (set for static addressing). The CCU terminal should be set to a static address of 192.168.0.1.

For more information, see [Setting IP Address Parameters](#), page 38

7.2. Multi-Camera Static IP System

In a Static IP system with more than one camera, the following devices are on the network:

- HG-TH/LE cameras or HG-TH Camera Controllers with Camera Heads.
- HSU
- CCU

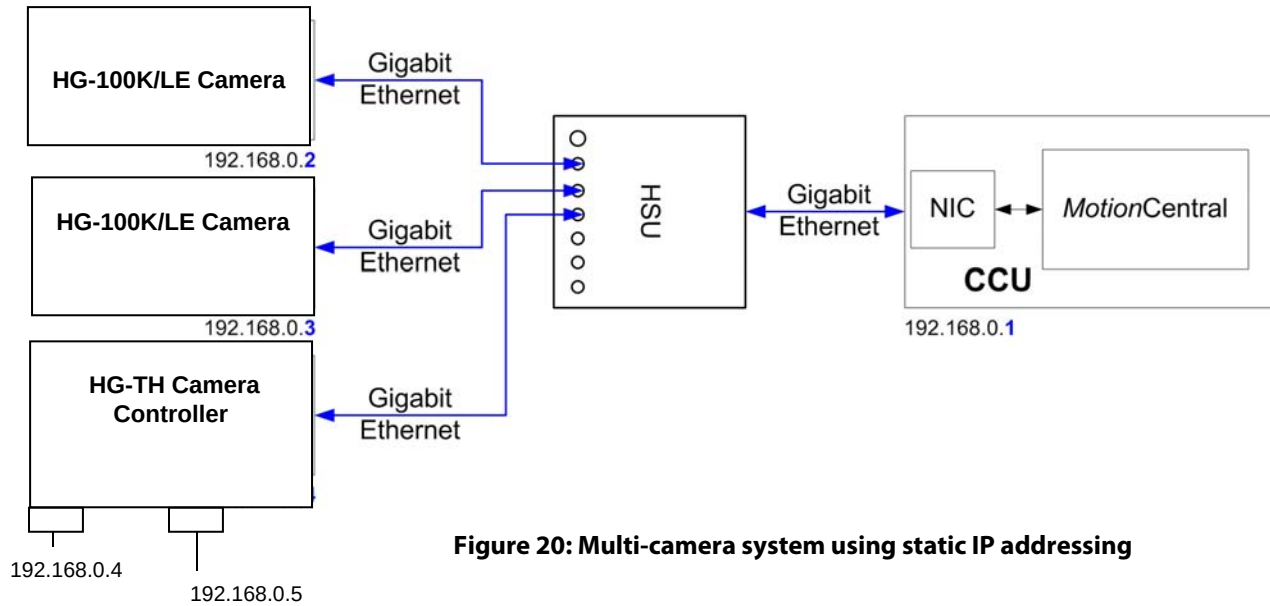


Figure 20: Multi-camera system using static IP addressing

Attach these devices with Ethernet cables using the HSU as a central connection point. The HSU is an unmanaged layer 2 only Ethernet switch so it does not have an IP address. Each camera, Camera Head port on the Camera Controller and the CCU must have a unique IP address. Set the CCU to 192.168.0.1 with each camera or camera port on the Camera Controller one increment above that. For example, three attached cameras could have the following IP addresses, 192.168.0.2, 192.168.0.3, 192.168.0.4.

For more information, see [Setting IP Address Parameters](#), page 38

7.3. One Camera DHCP System

Automatically assign IP parameters using the DHCP protocol. In a one-camera system, the devices on the network are:

- HG-100K/LE Camera or HG-TH Camera Controller and Camera Heads
- CCU (running DHCP server and client)

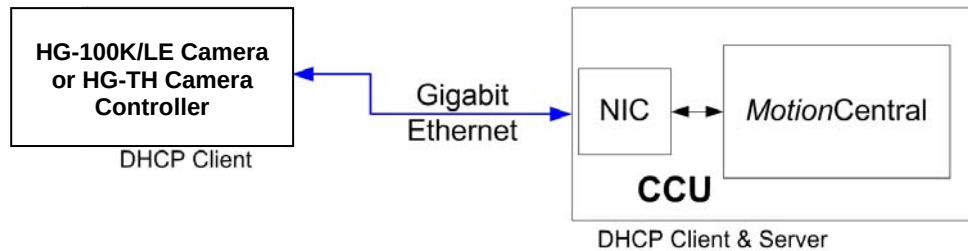


Figure 21: Single camera using DHCP

Connect these two devices with a single Ethernet cable using the 1000Base-T connector on the camera or Camera Controller and the Ethernet port of the CCU. The camera's or Camera Controller's 1000Base-T connector comes up at 100 Mbits and switches to 1000 Mbits when moving TIFF or Type-2 data. The NIC in the CCU PC must be capable of auto-negotiation between these two speeds.

All HG-100K/LE cameras and camera ports on the HG-TH Camera Controllers ship with the 1000Base-T port set with a factory-set default IP address and its DHCP client turned OFF (set for static addressing). To run with DHCP the camera must have its DHCP client turned ON.

In the DHCP configuration above, there is DHCP a client running in the camera or Camera Controller and the CCU. There must be a DHCP server running on the network, typically this is the CCU. A DHCP server does not come standard with the Windows operating systems. Redlake has tested a DHCP server called vDHCP Server for Windows, a product from Paul Smith Computer Services. Contact them on the Web at <http://www.pscs.co.uk>.

For more information, see [Setting IP Address Parameters](#), page 38

7.3.1. To Turn on DHCP

1. Select the System Tab from the Control Panel.
2. Set the IP address and the Subnet Mask to <0.0.0.0>, click on the Set button.

7.4. Multi-Camera DHCP System

In a DHCP system with more than one camera, the following devices are on the network:

- HG-100K/LE cameras or HG-TH Camera Controller with Camera Heads.
- 1 HSU or Commercial Switch
- CCU

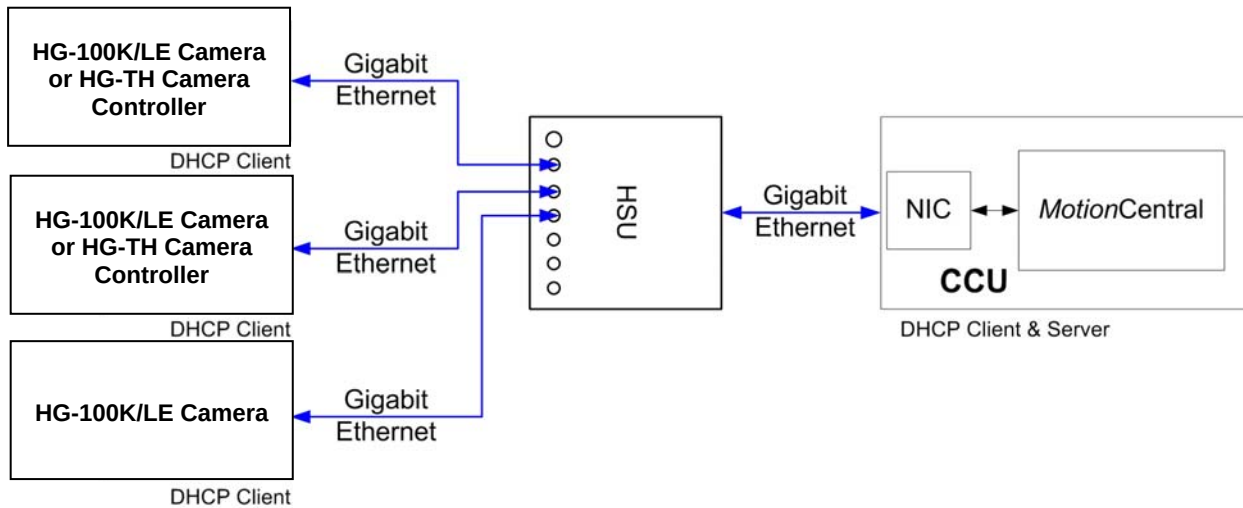


Figure 22: Multi-camera system using DHCP

Connect these devices with Ethernet cables using the HSU or commercial switch as a central connection point. The HSU is an unmanaged layer 2 only Ethernet switch so it does not have an IP address. Each camera or Camera Controller and the CCU must have their DHCP clients turned ON (static addressing turned OFF).

In the DHCP configuration above, there are DHCP clients running in the camera, Camera Controller and CCU. There must also be a DHCP server somewhere on the network; typically, this is on the CCU. A DHCP server does not come standard with the Windows operating systems. Redlake has tested a DHCP server called vDHCP Server for Windows, a product from Paul Smith Computer Services. Reach them on the Web at <http://www.pscs.co.uk>.

7.4.1. To Turn on DHCP

1. Select the System Tab from the Control Panel.
2. Set the IP address and the Subnet Mask to <0.0.0.0>, click on the Set button.

Note: install a vDHCP Server software or equivalent on the CCU.

7.5. DCU Configuration

Use the DCU for configuration and local camera setup. A DCU attaches directly to the DCU port on the camera or Camera Controller. Although complete camera system functionality is available, the DCU Port on the camera always runs at 100 Mbps. The Ethernet port in the DCU must be capable of running at this speed.

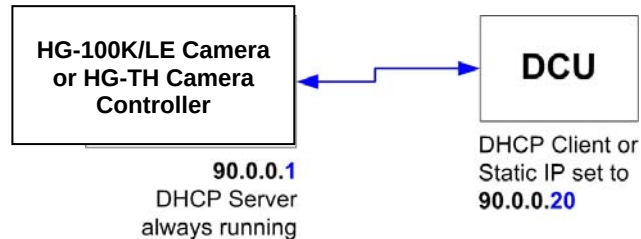


Figure 23: DCU direct connection to camera

The DCU moves between cameras and hubs quickly and efficiently without worrying about setting IP parameters. To allow for this flexibility the DCU Port on the camera and Camera Controller will therefore always have a DHCP server running in the camera and the attached DCU would be running with its DHCP client turned on. The DCU Port on the camera and Camera Controller cannot be set up to run a DHCP client, only a server.

The default IP addresses of the cameras or Camera Controller's DCU port is 90.0.0.1. Use this IP address to configure the pool of nine IP addresses to DHCP clients. This pool occupies the nine addresses immediately following the 90.0.0.1 IP address. For the default IP address of 90.0.0.1, the DHCP server will issue addresses ranging from 90.0.0.2 through 90.0.0.11.

Note: It is possible to run the DCU in static IP mode as long as the address is in the same subnet as the camera. For the default IP address of **90.0.0.1**, assign it an address of **90.0.0.20**.

7.5.1. DCU Connection through an HSU

Attach the DCU to the network through the DCU port on the HSU.

Note: All seven Ethernet ports on the HSU follow the same rules of configuration as above (see Multi-camera DHCP system)

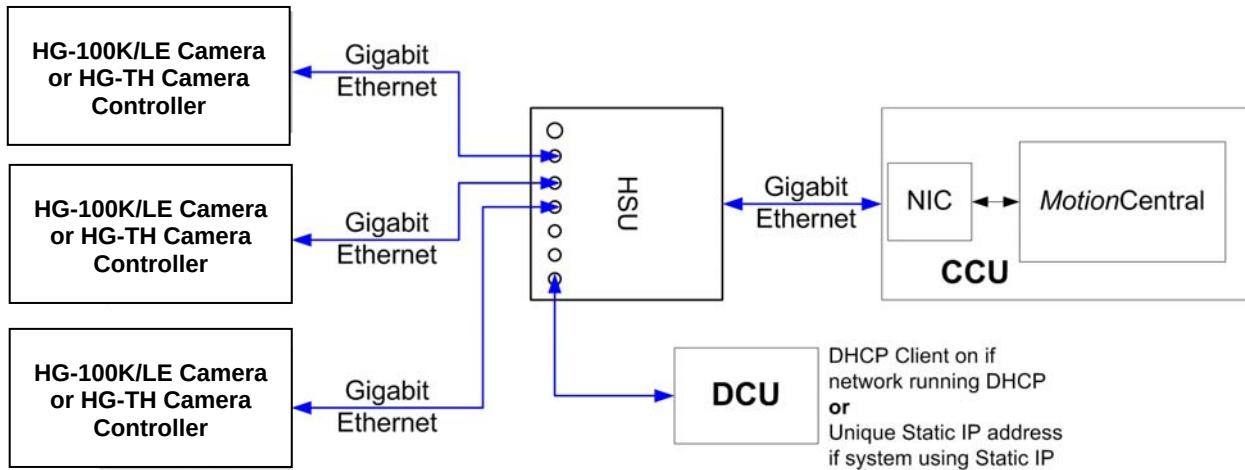


Figure 24: DCU connection at HSU

The DCU moves between cameras and hubs quickly and efficiently without worrying about setting IP parameters. It uses DHCP for this dynamic configuration capability. In this case, there are DHCP clients running in the camera, Camera Controller, CCU and DCU. There must also be a DHCP server somewhere on the network; typically, this is the CCU. A DHCP server does not come standard with the Windows operating systems. Redlake has tested a DHCP server called vDHCP Server for Windows, a product from Paul Smith Computer Services. Contact them on the web at <http://www.pscs.co.uk>.

It is also possible to run the above system in Static IP mode, in this case the DCU will have to have its DHCP client turned off and assigned a unique static IP address in the 192.168.0.x range like any other device in the system.

7.6. Legacy Cameras

It is possible to connect legacy cameras to the HG-100K/LE/TH system using a junction box. Use a D-Box for one legacy camera on the system; use a J-Box for multiple legacy cameras. Legacy cameras always run at 100 Mbps and always use static IP addressing.

Legacy Camera Static IP Configuration

In this configuration, all devices on the network are using static IP addresses including the cameras and the HD ports on the Camera Controllers. The network administrator must ensure that all devices have a unique static IP address in the same subnet.

Legacy Camera DHCP Configuration

In this configuration, there will be a mix of static IP addresses used for the legacy cameras and DHCP served addresses used in the cameras and HD ports on the Camera Controller. A DHCP server must be running (likely on the CCU) with DHCP client mode turned on for each camera, Camera Controller and CCU. This server will be leasing addresses to each DHCP client in a range of addresses. The server will only lease addresses from this range. The most important thing to guarantee is that there will be no chance of assigning duplicates; this could happen for instance if the legacy static addresses were in the same range of addresses that the DHCP server is leasing.

A common approach to eliminate duplicates that works on any DHCP server is to set up the DHCP server with the range of addresses that it will serve, and set up the static cameras or HD ports on the Camera Controller to be outside this range. The administrator must understand what ranges of addresses the DHCP server will be leasing.

The vDHCP server from Paul Smith Computer Services <http://www.pscs.co.uk> has a few advanced features to help with this type of mixed system. These are:

- Assign the IP addresses as normal within the legacy cameras and set an exclusion in vDHCP so that it does not assign that IP address to the cameras or HD ports on the Camera Controllers.
- Set up a reservation in vDHCP so that it will automatically assign a certain IP address to a specific named camera or HD port on the Camera Controller.

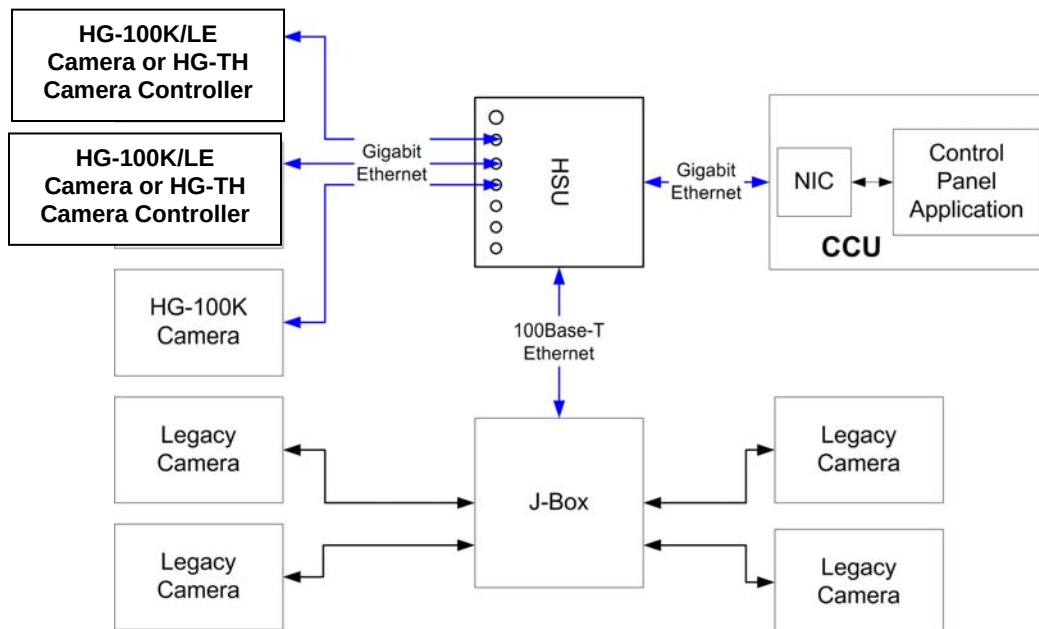


Figure 25: HG-100K/LE/TH system with multiple Legacy cameras using J-Box

7.7. Setting IP Address Parameters

The 1000Base-T ports on the HG-100K/LE cameras have a factory-set Static IP address of 192.168.0.2. The Camera Head (HD) ports on the two port HG-TH Camera Controllers have factory-set Static IP address of 192.168.0.2 and 192.168.0.3. The Camera Head (HD) ports on the four port HG-TH Camera Controllers have factory-set Static IP address of 192.168.0.2, 192.168.0.3, 192.168.0.4, 192.168.0.5. Use the same camera LAN subnet for camera LAN networks using Static IP addresses.

The CCU/DCU will automatically obtain its IP address from the DHCP server in the HG-100K/LE camera or the HG-TH Camera Controller.

Add new cameras one at a time and change the IP addresses using consecutive numbering. Setup the camera's High-G port IP parameters through the *MotionCentral* camera control software.

7.7.1. Change/Set Static IP Address of the HG-100K/LE High-G Port on a Static IP Network

1. Select a set of consecutive IP addresses to assign to the cameras.
2. Set up the CCU/DCU to obtain an IP address automatically. Exact steps will depend on your operating system.
3. Connect the Ethernet cable to the 1000Base-T Camera LAN port on the camera. Connect the other end of the Ethernet cable to the Ethernet port of the CCU/DCU.
4. Launch *MotionCentral*.
5. From the Camera List, select the desired camera and right-click on the exclamation point icon, to *Attach* the camera to the Camera LAN.
6. Click on the camera in the Camera List to select it (frame will be yellow), select the System Tab from the Control Panel. The text boxes at the top of the tab display the current static IP address and Subnet Mask of the High-G port of the selected camera.
7. Change the IP address (and Subnet mask if necessary) using standard decimal notation <xxx.xxx.xxx.xxx> and click Set button.

Note: The IP address of the camera DCU port CANNOT be changed. The DCU port is a permanent DHCP server.

7.7.2. Change/Set Static IP Address of the HG-TH Camera Controller Camera Port (HD) on a Static IP Network

1. Select a set of consecutive IP addresses to assign to each Camera port on the HG-TH Camera Controller.
2. Connect a Camera Head to HD-1 port on the HG-TH Camera Controller.
3. Connect the Ethernet cable to the 100Base-T DCU port on the HG-TH Camera Controller. Connect the other end to the Ethernet port of the CCU/DCU.
4. Set up the CCU to obtain an IP address automatically. Exact steps will depend on your operating system.
5. Launch *MotionCentral*,
6. From the Camera List, select the desired camera and right-click on the exclamation point icon, to *Attach* the camera to the camera LAN.
7. Click on the camera in the Camera List (frame will be yellow), select the System Tab from the Control Panel. The text boxes at the top of the tab display the current static IP address and Subnet Mask of the High-G port of the selected camera.
8. Change the IP address (and Subnet mask if necessary) using standard decimal notation <xxx.xxx.xxx.xxx> and click Set.
9. Repeat steps 3 through 8 for each Camera Head (HD) port.

8. Setting up Your Camera

This section explains how to configure, position, and focus cameras for using the *MotionCentral* Camera Control Software.

8.1. Application Startup and Software Configuration

1. Double-click the *MotionCentral* icon from the Windows desktop. Alternatively, from the Windows Taskbar, select Start > All Programs > *MotionCentral*.
2. From the Main Menu, select File > Setup to bring up the Configuration dialog box.
3. From the Network Adapter drop-down list, select the adapter for the camera LAN. Make certain that the adapter matches the NIC card connected to the camera LAN.

Note: Only one copy of the application program can be active at a time on a single machine, but multiple CCU and DCU computers can be simultaneously active.

8.2. Set up Network Communications Performance

The Network Performance box contains a slider to change the performance settings for network communications. When *MotionCentral* starts up it sends a GAP value to the camera. This GAP value is the number of camera clock cycles between packets of data sent from the camera to *MotionCentral*. The default GAP value of 2500 will be sufficient on most PCs that are 1 GHz and above in processor speed. Slower PCs may require a longer GAP value to download a Type-2 or TIFF file. If the error message "SegmentsOutOfOrder" displays when downloading a TIFF or Type-2, use the Network Performance slider to increase the GAP time.

1. From the Main Menu, select File > Setup to bring up the Configuration dialog box.
2. Move the Network Performance slider to the left to increase the download speed and to the right to slow the download speed and increase reliability.

Note: Increasing the GAP value increases the time between packets of data sent from the camera to the PC, which in turn increases the overall download time. Therefore, increase the GAP value using small increments only.

8.2.1. Set up Communications with Legacy Cameras

The Support HG/CR/TX check box enables *MotionCentral* to operate with older cameras; if this box is not checked, the CCU communicates with HG-100K/LE/TH cameras only, ignoring any HG, CR, or TX cameras that may be connected.

1. From the Main Menu, select File > Setup to bring up the Configuration dialog box.
2. Click on the box Support for HG/CR/TX

8.2.2. Set up the Message Level for the System Status Window

Used primarily for diagnostics, the Message Level drop-down lists five severity levels for logging messages in the log window.

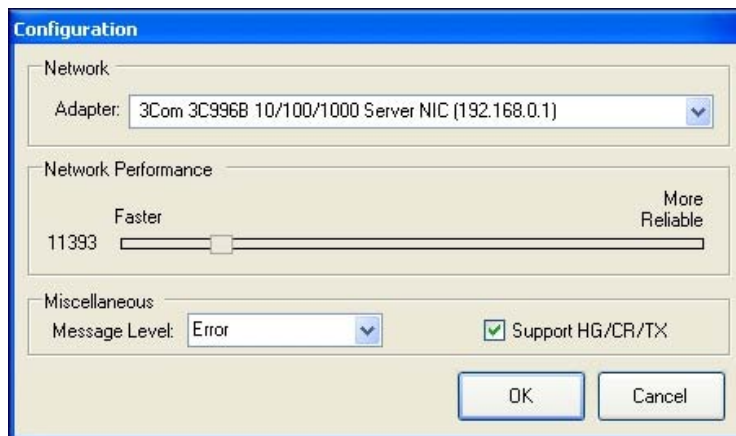


Figure 26: Configuration dialog box

8.2.3. Adding MotionCentral to the Windows Startup

Add the *MotionCentral* program application executable (.exe) file to the Windows Startup menu so that whenever the CCU boots, *MotionCentral* will automatically launch without locating and double-clicking the icon. This is particularly useful on a DCU.

1. Locate the *MotionCentral* folder and right-click on the *MotionCentral.exe* icon and select Create Shortcut.
2. Right-click on the *MotionCentral* shortcut and select Copy.
3. Navigate to the startup folder on the C drive, and Paste the shortcut in the Programs folder within the correct user's directory as shown in the example.

Directory Path:

NT4.0 C:\NT4.0\Profiles\Correct User\Start Menu\Programs\Startup

Win2K/XP C:\Documents and Settings\Correct User\Start Menu\Programs\Startup

Note: There may be more than one user profile on the system. Make sure the shortcut is pasted into the correct user's startup folder.

8.2.4. Adding Cameras to MotionCentral

1. Locate the desired camera in the Camera List window.
2. Right-click the exclamation point icon on the Thumbnail window. Click on the Attach pop-up.

There may be a delay of several seconds between the actual connection or disconnection event and the panel update. Updates occur at least every polling period (approximately every 10 seconds).

As cameras connect and disconnect from the system, the Camera List panel refreshes, adding or removing the corresponding icons from the panel. Control activities initiated through the Control Panel affect all selected cameras in the Camera List window.

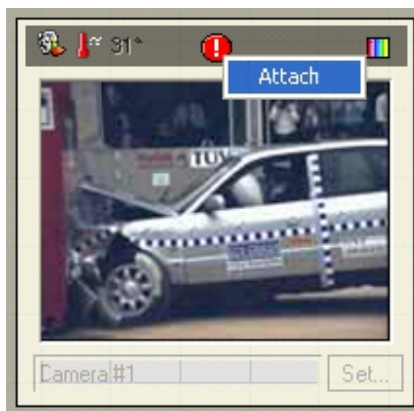


Figure 27: Camera Thumbnail with exclamation icon selected

8.2.5. Select Cameras

1. Locate the desired camera in the Camera List window.
2. Click the Thumbnail window to select it. The window frame will turn yellow when selected. Any control or status operation command will apply to that camera. To select more than one camera at a time, hold down the Ctrl key on the keyboard and click on the Thumbnail windows.

Selecting multiple cameras will affect parameters for all the cameras selected. *MotionCentral* highlights the parameter values when the cameras have different values. The highlighted field will represent the value of the last camera it scanned. Such a parameter field remains highlighted until the user changes it, thereby resetting that parameter for any selected camera(s). The Control Panel commands only affect the non-blank, non-highlighted parameters. Commands do not force commonality where it is not wanted.

8.2.6. Open a Live View Window

1. Locate the desired camera in the Camera List window.
2. Double-click inside the Thumbnail window. This will start a Live View window for the selected camera.

For more information, see [Viewing a Live Image](#) page 61.

8.3. Interface Overview (Panels, Context Menus, Toolbar, Viewing Area)

Once started, *MotionCentral* has two active areas: the Control Panel and the Camera List, with the System Status and the Command tabs displaying under the Camera List panel. Figure 28: Main Application Window shows the main application window with the Control Panel, Camera List, and a Live View Window for the active camera indicated by the yellow in the Camera List.

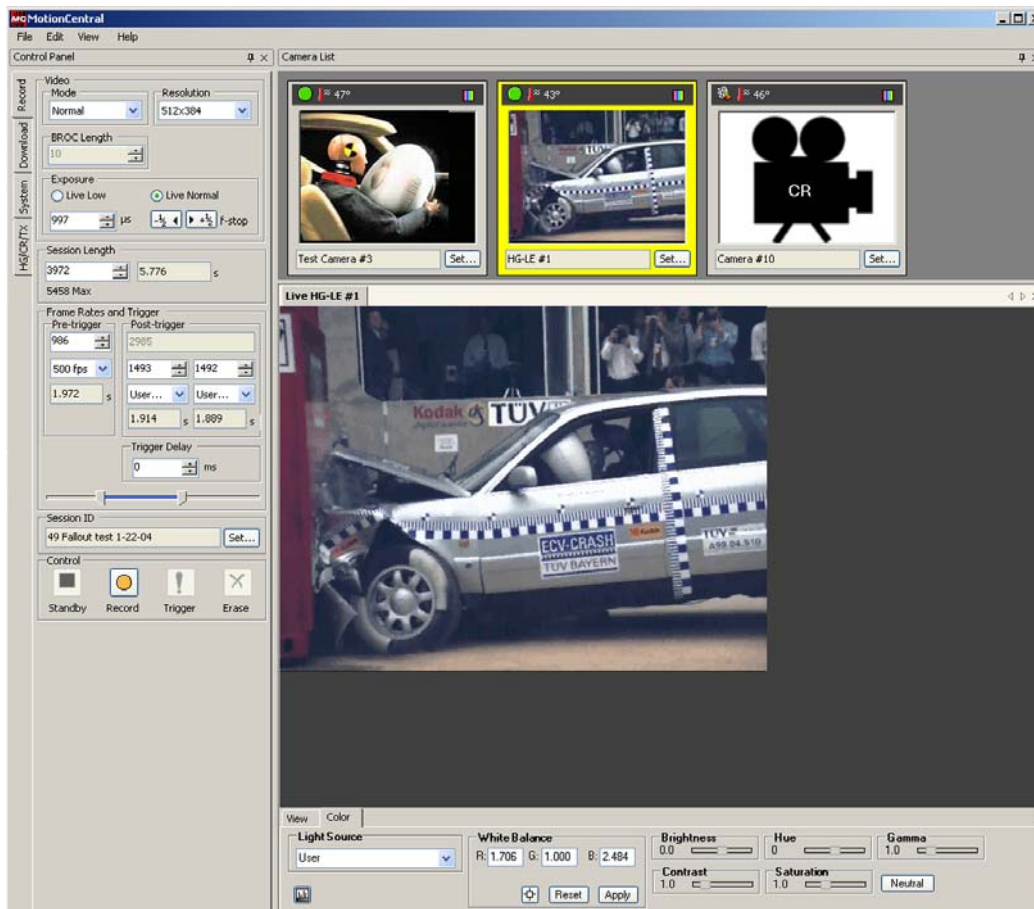


Figure 28: Main Application Window

8.3.1. Camera List

The application begins by attempting to determine the identity of each camera on the LAN. For each camera identified, *MotionCentral* places the appropriate icon in its Camera List window.

Each HG-100K/LE/TH camera icon can contain an active thumbnail showing an image recently captured by the camera. Legacy cameras do not support this activity; instead, it contains a camera silhouette labeled with the unit's model name.

To Open the Camera List

1. From the Toolbar, click on the View drop-down list
2. Select Camera List



At all times the Camera List window displays all the cameras known to the application. If the Camera List window is too small to display all the cameras detected, resize the window by clicking and dragging the lower border of the panel down further into the main window to view additional camera icons.

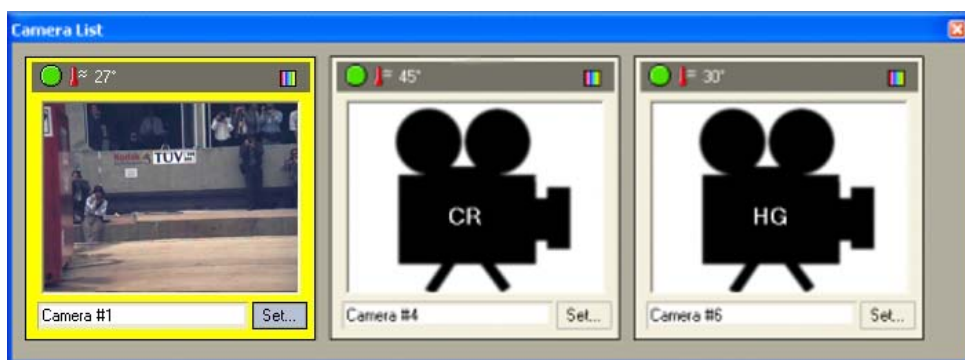


Figure 29: Camera List window, camera #1 selected

8.3.2. Control Panels

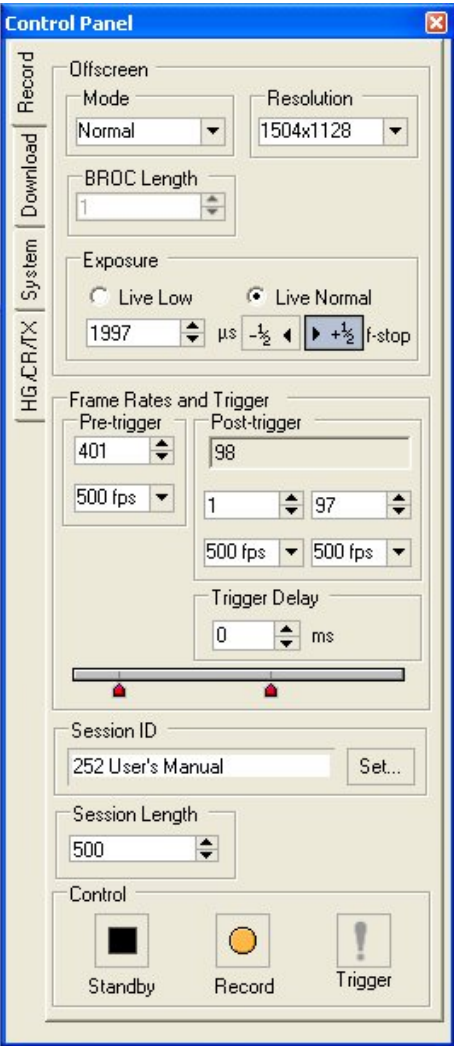


Figure 30: Control Panel

To Open the Control Panels

Record—controls camera settings during a live test. The primary controls govern the Resolution, Frame Rate, and Exposure. In addition, there are controls for the operational mode after recording is complete, for the session name, and for the operational power mode. This tab also provides software Trigger capabilities, and an Erase button to delete all recorded images from all selected cameras

Download—controls the download of an image sequence from a camera. The controls apply simultaneously to all selected cameras. Settings in this panel include format selection, border data controls, ability to save [.AVI](#) files, options for saving specific frames and saving to specific directories.

System—sets the system preferences for selected cameras. The program initialization file contains the settings from this panel and they are loaded each time the program starts. The primary controls govern network settings, date and time, camera orientation, and configuring trigger.

HG/CR/TX—controls the unique features of the legacy cameras such as the HG, CR and TX models. These features include video options, white balance, reticle and playback.

Video—controls the composite video output for the HG-TH.

8.4. Working with the Dockable Interface

MotionCentral incorporates four panels inside a standard application window. These panels include the Command, System Status, Camera List, and the Control Panel. The panels move around the application window to suit the preferences of the user, and to allow for maximum viewing of Live and Recorded image sequences on smaller viewing screens.

Docking—refers to the act of moving a panel to one of the four sides of the application window, where it attaches to the frame of the application window.

Pinning—refers to the clicking the pushpin icon so that the pin is pointing down and the panel is pinned to the window frame and will remain visible. If the pushpin is pointing left, this means that the panel is NOT pinned, and will retract into the application window frame, leaving only the panel tab showing. Simply placing the cursor over the tab will activate the panel making it slide to the open position for viewing and accessing the controls.

8.4.1. To Dock a Panel

1. Select the panel by clicking on its header bar. Make sure the pushpin icon in the header bar is pointing down, and drag the header bar of the panel to the desired position along the application window frame.
2. When properly positioned over an edge of the application window, a faint outline of the shape of the panel will display indicating the docking location..

Note: Always dock the Control Panel to either the left or right side to ensure visibility and access to all of its controls.

8.4.2. To Un-dock a Panel:

1. Select the panel by clicking on its header bar, and drag the header bar panel to the desired position inside the application window.
2. The panel will now be free-floating inside the application window, and can be moved anywhere.

Note: If a panel is un-docked, (free-floating) it CANNOT be pinned.

8.4.3. To Pin a panel

1. Dock the panel to the application window frame.
2. Move the cursor over the desired panel tab. The panel will fly-out from the application window frame.
3. While the panel is open and active, click on the pushpin icon so that the point of the pin is pointing down. The panel will now remain open and viewable.

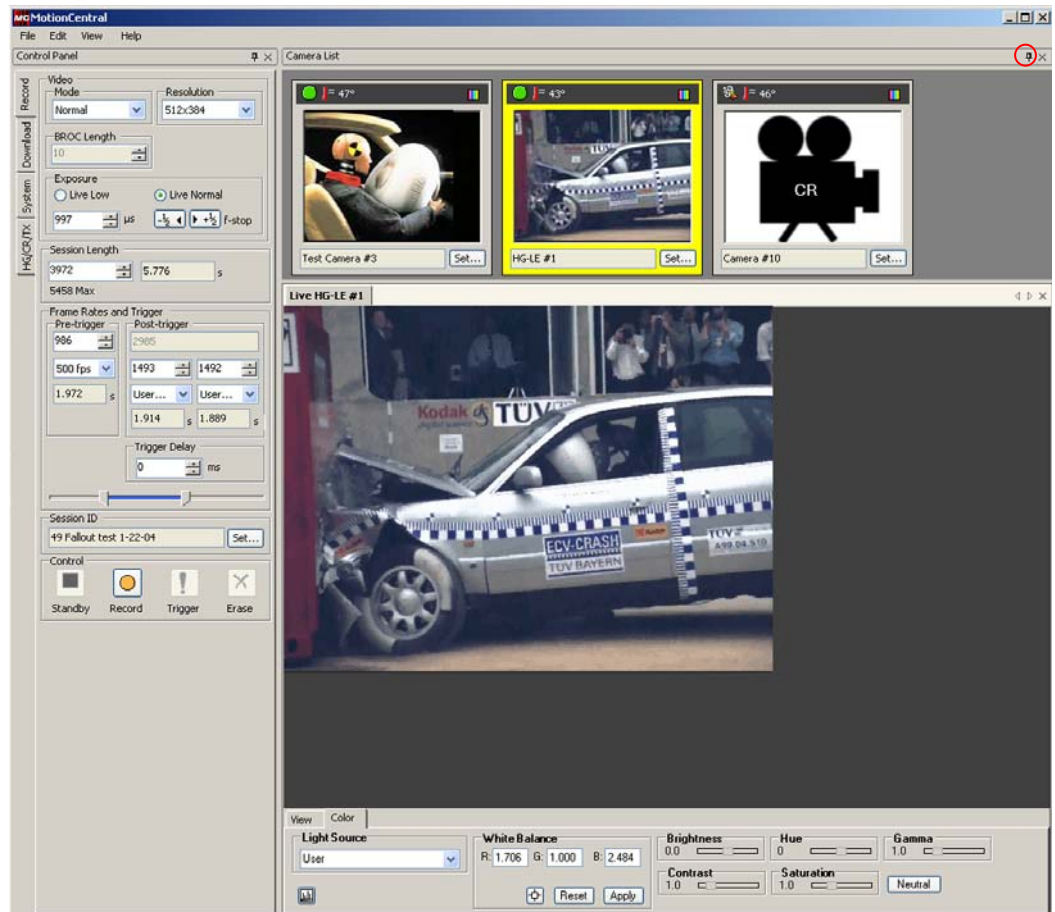


Figure 31: Control Panel pinned

8.4.4. To Un-pin a Panel

1. Select the panel by clicking on its header bar.
2. Click the Pushpin icon so that the icon is pointing left.
3. When the cursor moves off the panel, the panel will slide back to the application window frame leaving only the panel's tab showing.

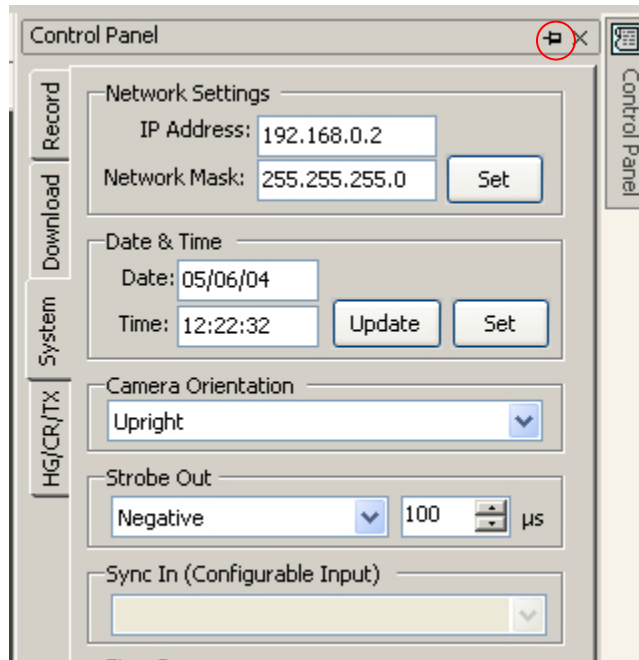


Figure 32: Control Panel "un-pinned"

8.4.5. Context Menus

Right click on the viewing area of a Live View window or Playback Window to display a pop-up menu. This menu offers three selections Copy, Border Data, Rotate and Image.

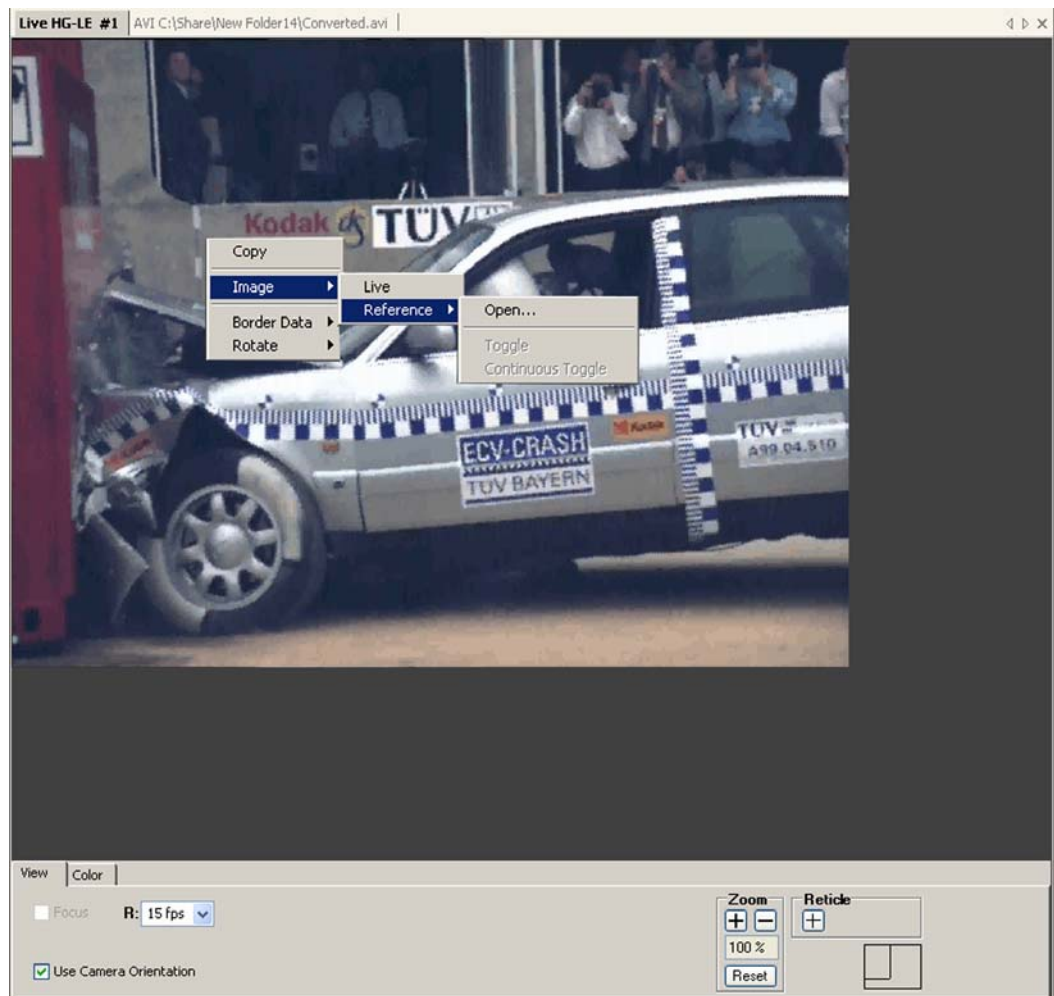


Figure 33: Live View Context Menu

8.5. Controlling Thumbnail Views

8.5.1. Live Thumbnail View

1. Right click on the camera's thumbnail view from the Camera List.
2. From the pop-up menu that displays, select the Thumbnail/Live option; the thumbnail image in the camera icon updates approximately every second.

8.5.2. Still Thumbnail View

1. Right click on the camera's thumbnail view from the Camera List.
2. From the pop-up menu that displays, select the Thumbnail/Still option to halt the acquisition of thumbnails. In this case, the last acquired image remains in the thumbnail area.

Note: These features are not available for legacy cameras. These cameras have an icon indicating the camera type.



Figure 34: Camera Thumbnails with context menu

8.5.3. Thumbnail Status Icons

Each camera icon displays one or more informational icons in its title bar. The area at the far left of the title bar displays one of the following three icons to indicate the camera record state:



A green light indicates the standby state.



A flashing yellow light indicates the record or ready state.



A flashing film reel icon indicates that a recording is in progress, and a non-flashing film reel indicates the recording is complete.

To play an image using the film reel icon:

1. Right-click the film reel icon.
2. Select Play from the menu to start a Live View display in a new window (or, if the window is already open, brings it to the front).

To erase an image using the film reel icon:

1. Right-click the film reel icon.
2. Select and confirm Erase from the menu to erase any recorded image the camera contains.

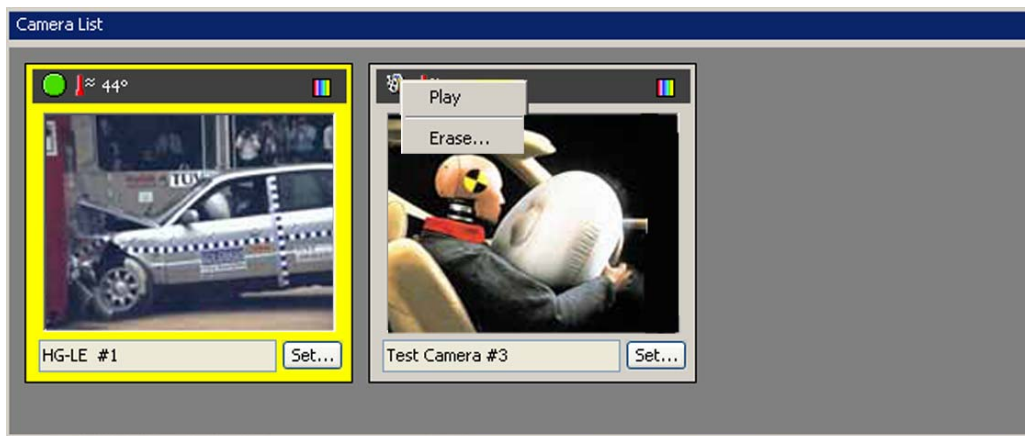


Figure 35: Camera List: Film Context



The thermometer icon for HG-100K/LE indicates the camera's internal temperature in degrees Celsius.



The HG-TH thermometer icon has displays two temperatures. The first temperature indicates the Camera Controller's internal temperature and the second temperature in parenthesis indicates the internal temperature of the Camera Head.



The color bar icon indicates a color-capable camera.



The black and white bar icon indicates a monochrome-only camera.



The Exclamation icon indicates that the camera is detached.

8.5.4. Arrange Cameras in the Thumbnail View

1. Select the System Tab from the Control Panel.
2. Use the drop-down list to select either alphabetical or chronological and click on the Sort button.

Note: Select appropriate alpha names for the cameras if they should consistently display in the same order.

8.5.5. Thumbnail Exposure

This control specifies how a remote HG-100K/LE/TH camera should set its exposure for thumbnails either Normal for full (brightly lit) recording illumination, or Low for setup illumination (with bright recording illumination off). *MotionCentral* always uses Normal exposure setting while recording.

1. Select the System Tab from the Control Panel.
2. Use the radio buttons to select either Normal or Low.

8.6. Record Modes

Use External Sync, ROC, BROc, and Ready mode settings in conjunction with the Configurable Input.

1. From the Record Tab, use the drop-down list to select from the following modes:

- **Normal**—in a camera LAN with no HSU or HSU without a Root Hub Cap, the cameras will use the internal clock. If there is a trigger input or software trigger, the cameras will work independently. If an HSU with a Root Hub Cap is present, all of the cameras on the camera LAN will use the root hub. The Frame Synchronization and Trigger at any camera or HSU will distribute through the entire network.
- **External Sync**—in a camera LAN with or without an HSU the cameras will use an external timing device connected to the Sync In BNC.
- **ROC (Record on Command)**—in a camera LAN with an HSU, the cameras will all synchronize using the same frame clock. Each camera will save images into memory for the interval that the configurable input holds true and idles when the configurable input in untrue – in other words, it is possible to save separate and distinct sequences of images until the memory is full.
- **BROC (Burst Record on Command)**—in a camera LAN with an HSU, the cameras will all synchronize using the same frame clock. Each camera will save a pre-defined number (burst) of frames to memory on each pulse, until the memory is full.
- **Ready**—is a hardwired record button. The camera will record when the configurable input goes true. When the camera is in the Ready mode, the camera is recording pre-trigger frames into the buffer and is waiting for a trigger.

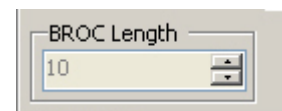


For related information, see [Configurable Connector](#), page 102.

8.6.1. BROc Length

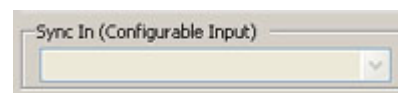
If the Record Mode is BROc, use the BROc Length to set the number of frames to save to memory.

1. Select Record from the Control Panel.
2. Select the number of frames using the BROc Length drop-down list.



8.7. Sync In

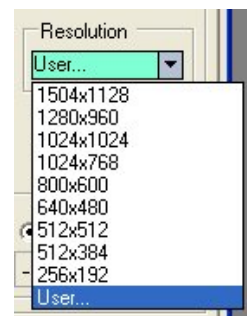
Defines the polarity of the Sync Signal, and sets the Sync to be active on the positive or negative signal pulse or the switch closure.



1. Select the System Tab from the Control Panel.
2. From the Sync In (Configurable Input) drop-down list, select Positive, Negative or Switch Closure.

8.8. Resolution

The Resolution box offers standard resolutions plus a user-defined option. The values selected must be acceptable to the camera. The HG-100K is capable of capturing images at user-defined resolutions up to 1504 X 1128. The HG-100K horizontal resolution may be set at increments of 32 and the vertical resolution may be set at increments of 8. The HG-LE is capable of capturing images at resolutions up to 752 x 1128. The horizontal resolution for the HG-LE may be set at increments of 16 and the vertical resolution may be set at increments of 8. The HG-TH is capable of capturing images at resolutions up to 752 x 564. The horizontal resolution for the HG-TH may be set at increments of 16 and the vertical resolution may be set at increments of 4.



1. Select the Record Tab from the Control Panel.
2. Use the Resolution drop-down list to select a resolution or select User to manually type in a resolution.

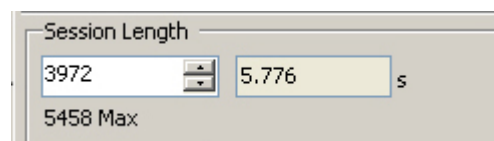
Note: The choice of resolution sets a limit for maximum frame rate.

8.9. Exposure

1. Select the Record Tab from the Control Panel.
2. At the Exposure box, use the radio buttons to select one of the following options:
 - **Live Low**— places the camera in low-light mode for framing and focusing the camera. This allows for a longer exposure than during actual recording.
 - **Live Normal**—sets the exposure to the same setting used during recording.
3. Type the exposure in microseconds directly into the text box or use the up and down arrow keys to select the exposure.
4. Click on the f-stop buttons to adjust the f-stop in ½ f-stop increments.

8.10. Session Length

1. Select the Record Tab from the Control Panel.
2. In the Session Length section, type the number of frames directly into the text box or use the up and down arrow keys. The box to the right indicates the session length in seconds. The numbers below the Session Length text box indicate the maximum number of frames allowed.



Note: If the selected camera is a legacy TX model, this will become a drop-down box with the possible values listed. Other legacy models do not have selectable session lengths.

For related information, see [Frame Storage Capacity](#), page 86.

8.11. Session ID

The Session ID box permits attaching a name to the recording run. It can be any string of up to 51 characters. When viewing border data in Live or Playback modes only the first three characters of the Session ID will be visible. The remaining characters are present in the headers of all downloaded TIFF, JPEG and Type-2 files.

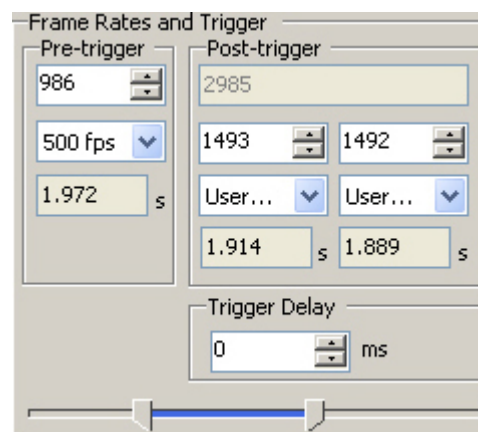


1. Select the Record Tab from the Control Panel.
2. Type the new name for the recording using up to 51 characters.

8.12. Frame Rate

When the camera receives the trigger signal, it names the current frame 0. All of the frames before the trigger are pre-trigger frames and all of the frames after the trigger are post-trigger.

With the HG-100K/LE/TH camera it is possible to record an event with up to three different frame rates in one session. Pre-trigger frames may be recorded at a different frame rate than Post-trigger frames. And, Post-trigger frames can be divided into 2 regimes that may, in turn, have different frame rates.



8.12.1. Select Frame Rate

1. Select the Record Tab from the Control Panel.
2. From the Frame Rate drop-down list, select the desired frame rate for Pre- and Post-trigger. Select User from the Frame Rate drop-down to select a frame rate from 5 fps to the maximum frame rate allowed for the specified resolution. Frame rates are selectable in increments of 5 fps.

8.12.2. Set Pre-trigger and Post-trigger (Dividing Session Length)

Once the Resolution and the Session Length are set, the session length can be divided between Pre-trigger and Post-trigger.

1. Select the Record Tab from the Control Panel.
2. Type the number of frames directly into the text box or use the up and down arrow keys. The box below the frame rate indicates the Pre-trigger in seconds. Alternatively, Pre- and Post-trigger can be set by clicking and dragging the slider tabs on the Trigger slider bar.

8.12.3. Trigger Delay

The Trigger Delay specifies the delay, in milliseconds, between receipt of the trigger and assertion of frame 0.

1. Select the Record Tab from the Control Panel.
2. Use the up or down arrow keys to set the Trigger Delay.

8.13. Trigger

8.13.1. Configure Trigger and Time Stamp Setup

1. Select the System Tab from the Control Panel.
2. Use the Trigger Input drop-down list to define the polarity of the Trigger In signal. It may be set to positive for a rising signal, negative for a falling signal, switch closure, or it may be disabled.
3. Use the up and down arrow keys to define the Trigger Debounce Delay, which is the length of time in microseconds that the trigger input signal must be "true" before it is considered valid by the camera.
4. Each frame includes a time stamp in microseconds. The time stamp value is included in frame's border data. Use the Timestamp drop-down list to select from the following options:
 - **Trigger Validation**—each frame's time stamp measures from the end of the trigger debounce time. Frame 0 will generally have a negative time stamp.
 - **Trigger**—each frame's time stamp measures from the actual time a valid trigger is received. This mode is not valid if using an HSU for the frame and trigger timing. Frame 0 may be either negative or positive depending on the frame rate, debounce delay, and the actual time within frame 0 that the trigger is validated.
 - **Beginning of Frame 0**—each frame's time stamp measures from the beginning of frame 0 exposure. Frame 0 will always have a time stamp of 0 in this mode. Frame 1 will have a time stamp of $0 + 1/\text{frame rate}$, etc.



Figure 36: Trigger and Time Stamp Setup

8.13.2. Offset and Trigger Timing

The HG-100K/LE/TH writes a time stamp into the border data of each captured frame. The following examples will help you understand the meaning of this measurement and how the setup and trigger mechanism affect its interpretation.

The *MotionXtra* system asserts the trigger in the following forms:

- Software trigger from *MotionCentral*
- Hardware trigger applied directly to a camera not on a network using an HSU.

- Hardware trigger applied to a camera or HSU on a network where a valid root hub is present.

A camera can be set up to reference its time stamp to one of the following three points in time:

- Trigger—is the actual time that the trigger is activated.
- Trigger Validation—is post signal validation.
- Beginning of Frame 0—is the beginning of the exposure.

Example 1 Software Trigger

In the case of a camera or a network of cameras triggered via software, it is unknown how much time will elapse between the time when an operator clicks on the trigger icon and when any given camera validates that trigger. All cameras on the network will trigger at different times, therefore, the offset time from Trigger or Trigger Validation will not be applicable. Setting the time stamp reference to the Beginning of Frame 0 will give an accurate measurement for each camera. The time stamp for frame 0 will be zero, and the time stamp for frame 1 will be 1/frame rate, etc. If there is more than one camera, it is difficult to discern an accurate relative timing for each camera's frame 0.

Example 2 Hardware trigger applied to Trigger In BNC (not on an HSU network with a valid root hub)

If the camera's time stamp reference is set to trigger, the time stamp offset will be the time between when the valid trigger assertion and frame 0. In Figure 37, the trigger occurred 74 μ s before frame 0. In this case, the time stamp for frame 0 will be 74 μ s.

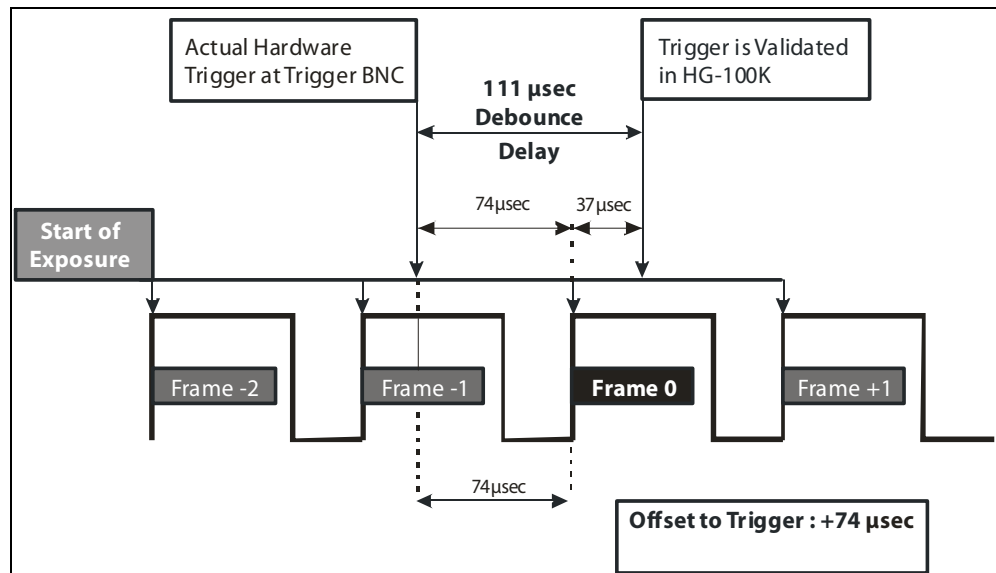


Figure 37: Time stamp offset to Trigger +74 μ s

Note: The frame rate for the example is 10,000 frames per second. At 1,000 frames per second with a Debounce Delay of 100 μ s the time stamp (offset to trigger) will usually be a negative number.

If the camera's time stamp reference is Trigger Validation, the measurement in the border data is the offset from the trigger validation time. In Figure 38 the trigger occurred 74 μs before frame 0 but trigger validation occurs 111 μs later. If the time stamp reference is Trigger Validation, the offset of frame 0 is -37 μs .

The trigger offset is ignored if the camera's time stamp is set to the Beginning of Frame 0. The time stamp for frame 0 will be zero and the time stamp for frame 1 will be 1/frame rate, etc.

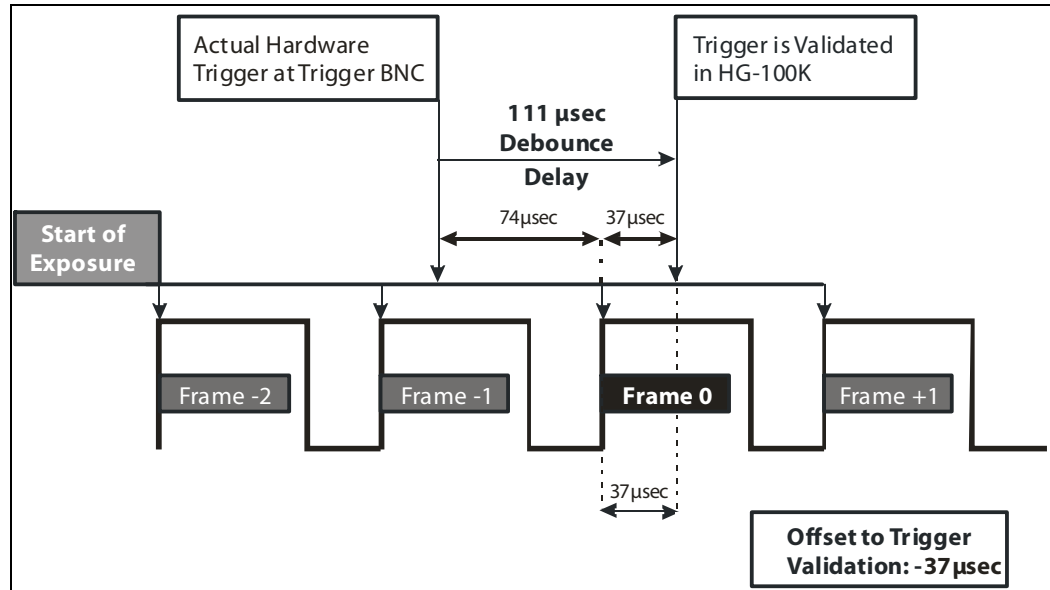


Figure 38: Time stamp offset to trigger validation -37 μs

Example 3 Hardware trigger applied to any camera or hub with cameras attached to an HSU network with a valid root hub

A root hub on the camera LAN, sends an encoded clock signal for frame timing, time stamp and Trigger.

In this case, there is a relatively small, unknown propagation delay between the trigger pulse and the arrival of the pulse at the root hub. There is a 100- μs uncertainty from the time the root hub gets the trigger and when the trigger is encoded into the sync line and is sent to all the cameras. For this reason, using Trigger for the camera's time stamp reference will not give accurate results.

Use Trigger Validation for the camera's time stamp reference, because the cameras will validate the triggers at the same time.

At each camera, there is an additional 0 to 500- μs countdown to trigger before trigger validation, depending on the number of hubs between the camera and the root hub. The result is that the trigger validation will be 500 to 600 μs after the time the trigger is sent. The cameras will validate their triggers at the same time and synchronize to the trigger output sent to the legacy cameras.

The IRIG Trigger (output) at each HSU is true at the same time all of the cameras validate the trigger. The value of the offset to frame 0 when using an HSU network represents the time (within a microsecond or so) that the IRIG Trigger on any hub goes true.

To calculate exactly when frame 0 occurred when using an IRIG Trigger:

1. Set the time stamp reference to Trigger Validation.
2. Monitor the time the IRIG Trigger at any HSU goes true.
3. Subtract the border data frame 0 offset (setting the time stamp reference to trigger with a valid root hub will not yield accurate results).

If the camera's time stamp is set to the Beginning of Frame 0, the camera will ignore the trigger offset. The time stamp for frame 0 will be zero, and the time stamp for frame 1 will be 1/frame rate, etc.

For related information, see [Appendix G Formulas](#), page 113

8.13.3. IRIG Support

The HG-100K/LE/TH system connects to a CCU that has an ITS6146G IRIG board installed to provide IRIG/GPS timing data for captured recordings. The IRIG Trigger-In on this board connects to the IRIG trigger-Out on the root HSU.

At initialization, *MotionCentral* scans the CCU and if an IRIG board is found, it appends the Timing Source drop-down list in the control panel, and adds IRIG: True to the border data for that camera session.

When a trigger is applied, the IRIG board recognizes it at the same time as all the cameras and hubs as described above in the HSU section. The HG-100K/LE/TH and HSUs have the intelligence to know where they are on the network and how much delay (+ or -) is necessary to maintain proper synchronization of all recorded images.

When images playback or download and the IRIG is true, *MotionCentral* sends a command to the camera to pull the trigger time from the IRIG Board. *MotionCentral* then appends each frame's border data accordingly with IRIG days, hours, minutes, seconds, and μ s.

Since the border data contains IRIG data at the time of playback or download, connect all cameras to the CCU with the IRIG board installed in order to download recorded frames with the correct IRIG border data.

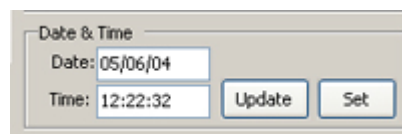
For a complete IRIG solution, contact Speed Vision at www.speedvisiontech.com

For related information, see [Appendix G Formulas](#), page 113

8.14. System Date and Time

This area contains text boxes to display and set the time settings internal to the camera.

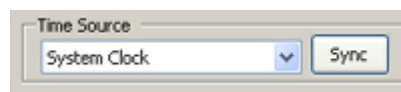
1. Select the System Tab from the Control Panel.
2. To load the current camera time settings, press the Update button in the Date & Time section. Alternatively, to force a date and time setting to a camera, set the desired values in the text boxes and click the Set button.



Note: Select all cameras on the camera LAN before setting date and time. Camera clocks will run independently and not synchronously, so occasional re-synchronizing may be necessary.

8.15. Time Source

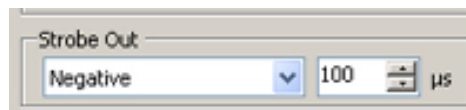
The Time Source controls the time base source for the selected cameras. The default setting is System Clock. If an IRIG/GPS board is present, *MotionCentral* will automatically add IRIG and GPS options to the drop-down list.



1. Select the System Tab from the Control Panel.
2. Use the Time Source drop-down list to select the Time Source and click on the Sync button.

8.16. Strobe

Strobe Out provides a Synchronization Output Signal Pulse from a camera used for synchronizing any other equipment such as strobes, lights or other cameras. The signal is true for the interval that the exposure is true.



The Strobe Out delay function allows adjustments the beginning of the pulse to accommodate for timing differences in equipment. It is adjustable in increments of 5 μs from -100 to Exposure -7 μs depending on the exposure. As exposure approaches the upper limits, it reduces the amount of negative adjustment. When exposure is set to the maximum possible, there is no negative delay adjustment allowed. As exposure approaches the lower limits, the amount of positive adjustment is impacted. When exposure is set to 5 μs , there is no positive delay allowed.

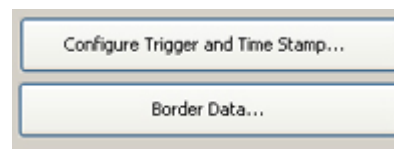
1. Select the System Tab from the Control Panel.
2. In the Strobe Out section, use the drop-down list to select the Strobe Out polarity.
3. Use the up and down arrow keys to adjust the Strobe Out Delay.

Note: If an external timing source is used, this feature is disabled.

For related information, see [Appendix G Formulas](#), page [113](#).

8.17. Border Data Setup

The Border Data button opens a dialog box that displays check boxes for each of the possible border data items. Both the Live View and the Playback View windows provide separate controls to modify the selections as needed.



1. Select the System Tab from the Control Panel.
2. Click on the Border Data... button at the bottom of the System Tab.
3. Check the boxes next to the Border Data items you wish to display.

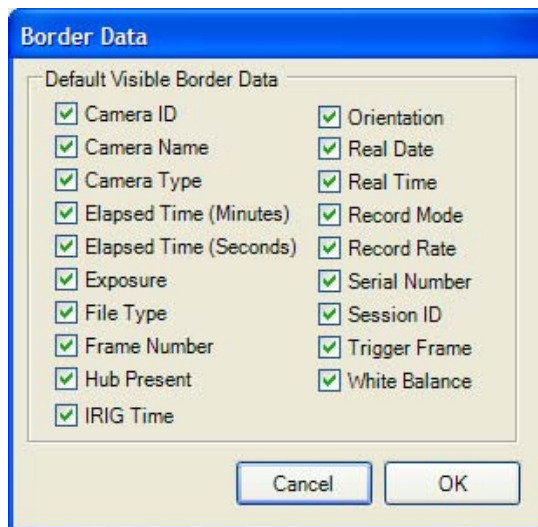


Figure 39: Border data display selections

9. Viewing a Live Image

9.1. Open a Live View Window

1. Locate the desired camera in the Camera List window.
2. Double-click the Thumbnail window. This will start a Live View window for the selected camera.

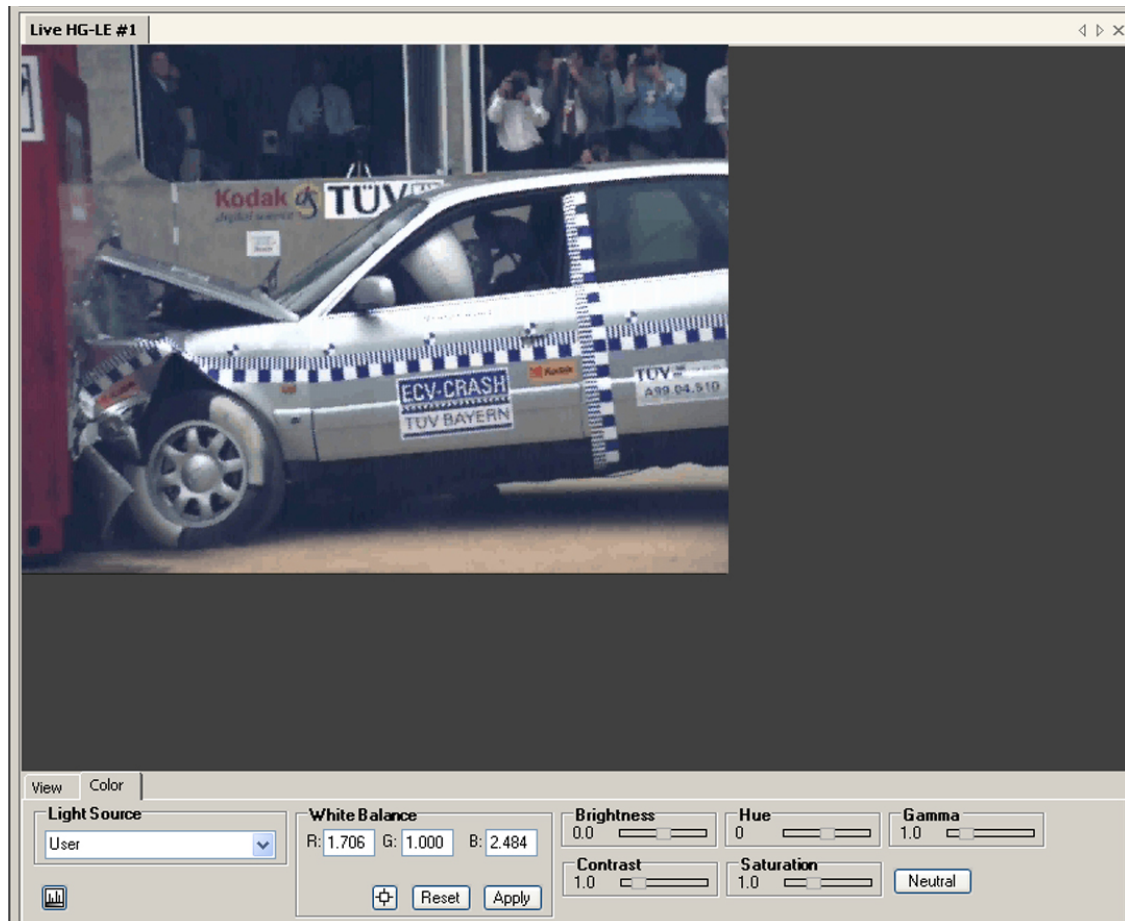


Figure 40: Live View Window

9.2. Display Control Options

Various display options are available while the Live View window is open. They are located along the bottom of the window, below the image. These controls include display options and color correction.

9.2.1. Focus the Image at the Selected Resolution

For resolutions on a HG-100K above 600x800, the viewable area within the Live View window reduces to 25 percent of the actual resolution.

1. Select the View tab below the Live View window.
2. Check the Focus box. This zooms to the center of the image and displays the image pixel for pixel.

9.2.2. Change the Display Rate

1. Select the View tab below the Live View window.
2. Use the drop-down list to select the desired display rate.

Note: Display rates depend on the network performance.

9.2.3. Check the Region of Interest

1. Select the View tab below the Live View window.
2. At the far right of the status bar is the Positional icon that indicates what portion of the entire image or region of interest displays in the window and the placement of that portion relative to the entire image. If 100 percent of the image is visible, the two rectangles coincide.

9.2.4. Zoom In or Zoom Out on the Image

1. Select the View tab below the Live View window.
2. To zoom in on the image, click on the + button adjacent to the Positional icon. To zoom out on the image, click on the – button.
3. To reset the zoom, click on the Reset button.

9.2.5. Display the Reticle

The reticle is a pair of white crossed lines drawn over the image. When the reticle is enabled, a position indicator beside the reticle control button shows the current pixel position of the reticle cross point.

1. Select the View tab below the Live View window.
2. Click on the reticle icon to turn on the reticle.
3. To move the reticle, place the cursor over the line and drag it to the position desired.

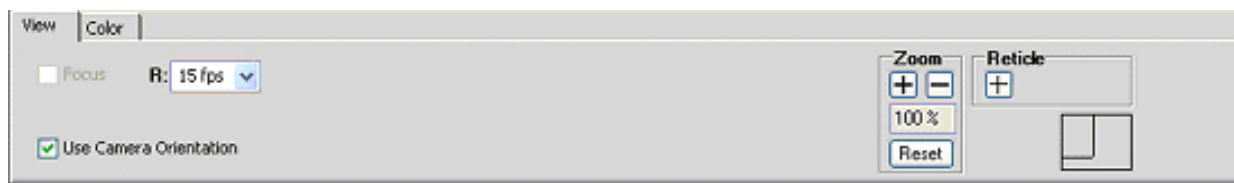


Figure 41: Live View display options

9.2.6. Camera Orientation

The HG-100K/LE/TH cameras allow different mounting orientation options. *MotionCentral* allows the orientation of the Live View or Playback to match the physical orientation of the camera setup. This information is available in the border data.

1. Select the System Tab from the Control Panel.
2. Use the Camera Orientation drop-down list to select the orientation that matches the physical setup.

9.2.7. Select Camera Orientation in Live View

1. Select the View tab below the Live View window.
2. To use the same camera orientation as selected in the System Tab, check the Use Camera Orientation box.

9.2.8. Control Light Source

1. Select the Color tab below the Live View window.
2. Use the Light Source drop-down list to select from the following Light Source options:
 - Daylight
 - Tungsten
 - Metal Halide
 - User (default setting)

9.2.9. Correct White Balance

1. Select the Color tab below the Live View window.
2. Set the Light Source drop-down list to User.
3. Select a neutral-gray target object in the field of view illuminated by the same lighting used during recording. A photographic gray card is ideal.
4. Click on the White Balance reticle button and move the reticle so that the central box is located completely within the target object.
5. Observe the reticle pixel values and adjust the exposure setting or illumination of the target object until none of the values is at or near saturation (255).
6. Click the Apply button until all pixel values are within a few counts of each other and/or the color of the scene displays true.

9.2.10. Correct Gamma

The Gamma Correction Slider adjusts the image to suit the gamma curve of the display device. Gamma values for CRT displays are likely to be in the 1.8 to 2.2 range, while values for LCD/TFT displays are likely to be in the .8 to 1.2 range. If the gamma is set too low, images will tend to appear dark and have too much contrast. If the gamma is set too high, images will tend to appear light and washed-out with too little contrast.

1. Select the Color tab below the Live View window.
2. Click and drag the Gamma Slider to adjust the color values for Gamma

9.2.11. Color Correction for Images

1. Select the Color tab below the Live View window.
2. Click and drag the appropriate slider to adjust the color values. The following sliders are available:
 - Brightness
 - Contrast
 - Hue
 - Saturation

Select the Neutral button to set the values back to their original state.

Note: Adjusting these sliders affects only the viewed image. The camera will not save changes to the HG-100K/LE/TH image files.

9.2.12. Display the Live View Histogram

1. Select the Color tab below the Live View window.
2. Click on the Histogram Icon. The Histogram displays values for the following:
 - Luminosity
 - Red
 - Green
 - Blue

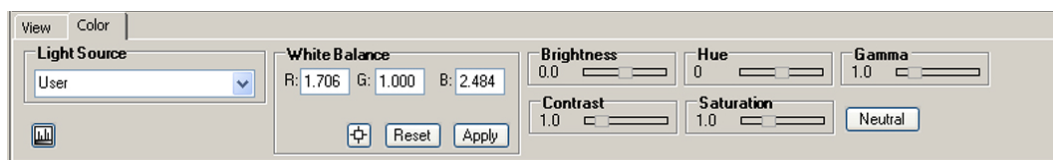


Figure 42: Live View color control

9.3. Viewing a Live Image on a NTSC/PAL Monitor with the HG-TH System

The HG-TH system provides a connection to an NTSC/PAL monitor for viewing images while in Live View. Control the output using the *MotionCentral* software or directly from the Camera Controller.

9.3.1. Controlling the Output to a NTSC/PAL Monitor from the Camera Controller

1. Connect one end of the BNC cable to the NTSC/PAL monitor and connect the other end to the BNC connector below the Head Select button on the HG-TH Camera Controller.
2. To output the video to the NTSC/PAL Monitor press the Head Select button on the Camera Controller. In multi-camera configurations, press the Head Select button again to view the video from other Camera Heads.

9.3.2. Controlling the Output to a NTSC/PAL Monitor with MotionCentral

1. Connect one end of the BNC cable to the monitor and connect the other end to the BNC connector below the Head Select button on the HG-TH Camera Controller.
2. From the Camera List, select the desired Camera Head.
3. From the Control Panel, select the Video tab.
4. From the drop-down list, select NTSC or PAL video output.
5. From the On Screen Display drop-down list, select one of the following on-screen information options:
 - OFF
 - Time
 - Name and ID
 - Time, Name and ID
6. Click the Video Output On/Off monitor icon to output the video to the monitor. In multi-Camera Head configurations, click on the Video Output On/Off monitor icon to select a different Camera Head to output to the NTSC/PAL monitor.

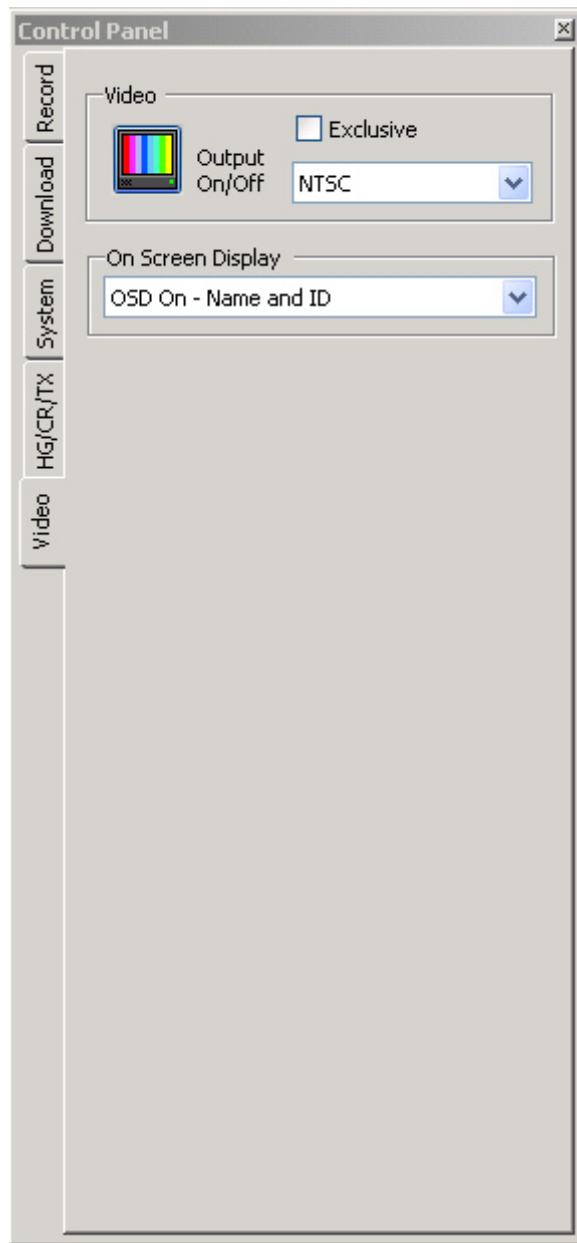


Figure 43: Video tab for NTSC/PAL output

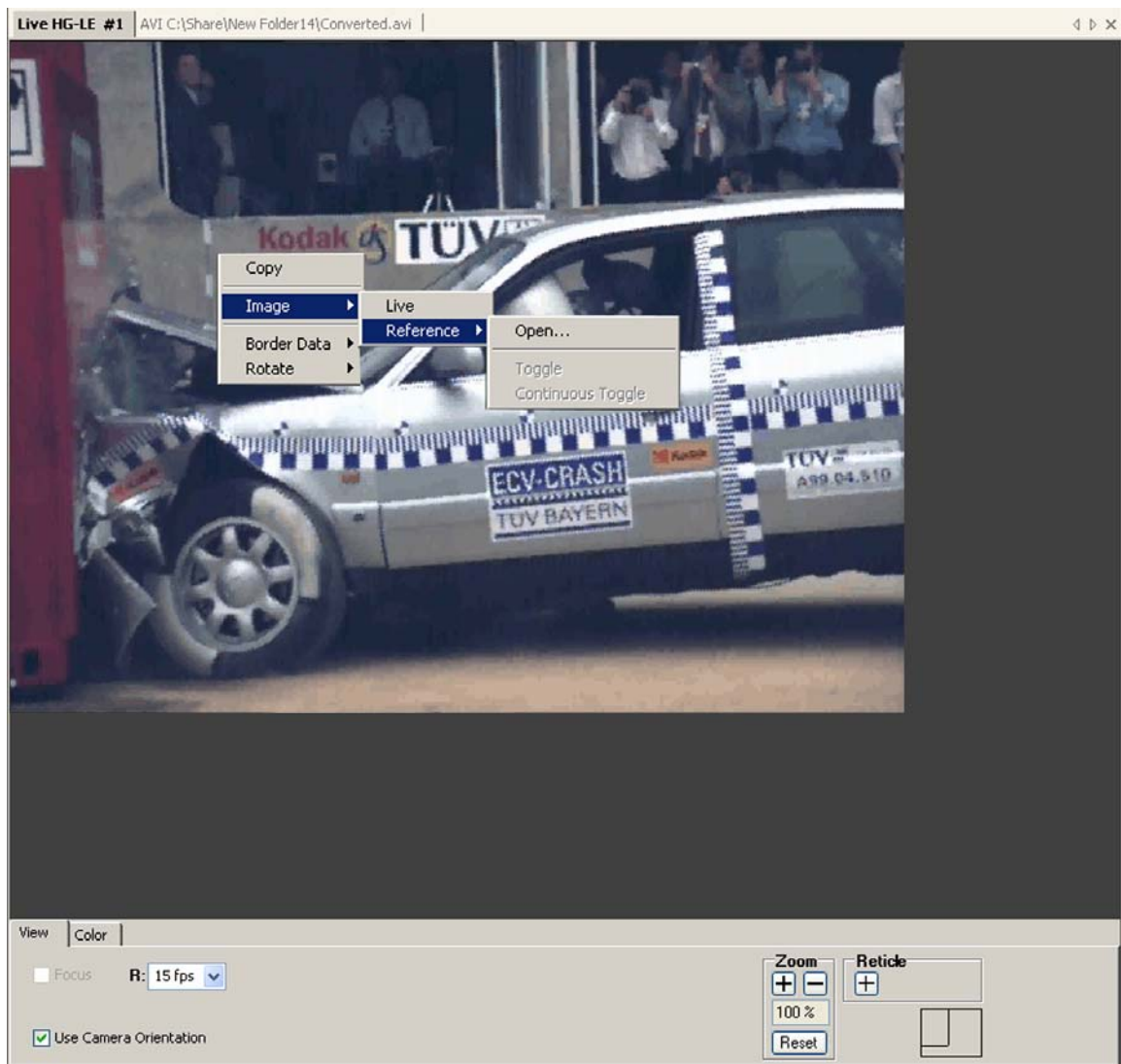


Figure 44: Live View: Image Reference Context

9.3.3. Copy a Live View Image to the Clipboard

1. Right-click on the image in the Live View area. A pop-up list displays.
2. From the pop-up list, select Copy. The image in the Live View window copies to the Clipboard.

9.3.4. Control the Border Data Menu Display from the Context Menu

Right-click on the image in the Live View area. A pop-up menu will display.

Select Border Data from the pop-up menu. An additional menu offers the following options border data display options:

- Select Show to enable border data display.
- Select Hide to disable border data display.
- Select Fields to open an additional menu and select the border data elements.

Note: This controls the displayed border data for the selected camera only, for as long as the view remains open.

9.3.5. Rotate the Image in Live View

1. Right-click on the image in the Live View area. A pop-up menu will display.
2. Select Rotate. An additional menu offers the following options:
 - 90° CW (clockwise, or right)
 - 90° CCW (counter-clockwise, or left)
 - 180°. Flip (reflect) Horizontal
 - Flip Vertical
 - Reset command restores the image to its original state.

Note: The rotation option is for display only. The system does not save rotation changes to the image file.

9.3.6. Toggle Between Live Image and Reference Image

1. Right-click on the image in the Live View area. A pop-up menu will display.
2. Select Image. An additional menu offers the following options:
 - The Open... command opens a file browser to select a previously saved image to reference against the currently opened image.
 - The Toggle command switches the displayed image between the newly opened reference image and the live view currently displayed.
 - The Continuous Toggle command toggles the two images at a regular interval using the values set in the System Tab.

9.3.7. Set the Toggle Rate Between Live Image and Reference Image

1. Select the System Tab on the Control Panel.
2. At the bottom of the System Tab, use the Image Toggle Rate up and down arrows to select the toggle rate in seconds.

10. Recording an Event

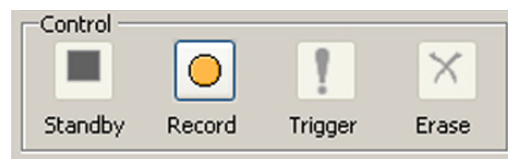
10.1. Overview

MotionCentral has several camera settings such as the resolution, frame rate and exposure that require configuration before recording an event. For more information on these settings, see the function sub-heading under [Setting up Your Camera](#), page 40. The Record Controls provide the means to begin a recording, send a software trigger, stop recording and delete the recording from the camera memory.

10.2. Record Controls

MotionCentral provides four record function buttons including:

- **Standby**—restores the imager to Standby mode, canceling any recording in process. Standby mode is not available after the imager receives a trigger. It cancels live view on a video monitor for legacy cameras.
- **Record**—puts the camera into Record mode, or Ready. In this mode, the camera records pre-trigger frames, storing them into a circular buffer until it receives a trigger.
- **Trigger**—send a software trigger signal to all currently selected cameras over the camera LAN.
- **Erase**—deletes the images in the camera.



10.2.1. To access the Record Controls

1. Select the Record tab from the Control Panel.
2. At the bottom of the Record tab, select the desired Record control button.

11. Downloading, Opening and Saving Image Files

11.1. Select File Format (Raw, AVI, etc.)

1. Select the Download tab from the Control Panel.
2. Use the Format drop-down list to select from the following options for an HG-100K/LE/TH camera (options will differ for Legacy cameras):
 - JPEG
 - TIFF
 - TY2
 - AVI

11.2. Save Border Data to XML

MotionCentral creates a separate XML-based file to store the border data. The XML file is ideal for viewing archived data without parsing the image file or opening *MotionCentral*.

1. Select the Download tab from the Control Panel.
2. Click on the Save Border Data to XML check box.

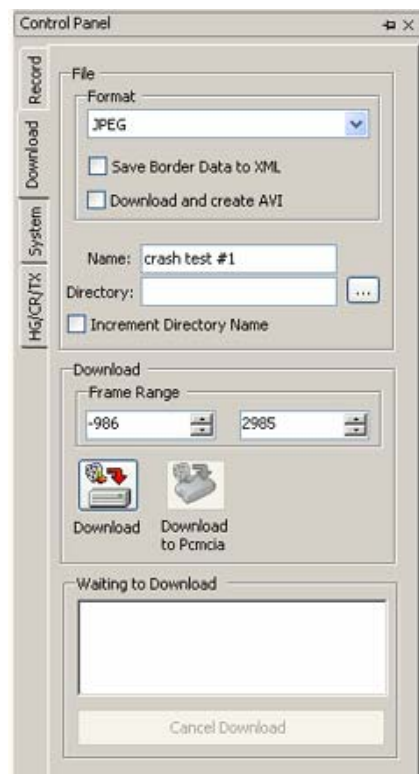
11.3. Download and Create AVI Formatted File

The Download and Create AVI feature creates a motion video file in *.avi format. The *.avi files are motion files and are ideal for fast previews from the *MotionCentral*'s Playback View.

1. Select the Download tab from the Control Panel.
2. Check the Download and Create AVI check box.

11.4. Create a File Name and Save to a Directory

1. Select the Download tab from the Control Panel.
2. Type a file name in to the Name text box. If the text box is blank, the frame 0 filename will be <Camera Name Shown in Camera List><extension>. Entering a prefix in the box, will replace the <Camera Name Shown in Camera List> in the filename.
3. Type a directory name in to the Directory text box or use the "... " button to select a directory.
4. Click on the Increment Directory Name check box to specify the selected directory for the next download. This is especially useful when downloading multiple cameras.



11.5. Select a Frame Range to Download

MotionCentral allows specification of the range of frames to download.

1. Select the Download tab from the Control Panel.
2. Use the Frame Range text boxes to enter the numeric frame limits directly, or use the up and down arrows to select the range.

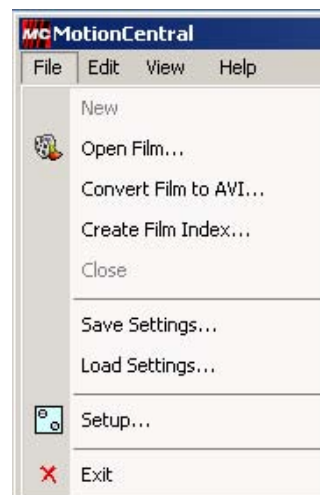
11.6. File Download

1. Select the Download tab from the Control Panel.
2. Click on the Download icon to begin the download. While the download is underway, a progress bar is visible. The progress bar window contains an Abort button to terminate the download if necessary.

11.7. Open a Downloaded File

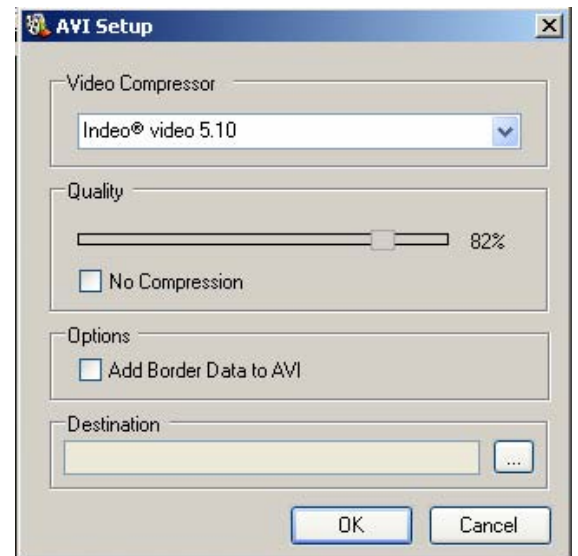
1. Select File at the top of the *MotionCentral* toolbar.
2. Select Open Film... from the drop-down list.
3. Select the Film Index folder and select the desired *.AVI or *.IDX file. The *.IDX file is an index of still files created by the software and added to the image file folder. The *.AVI files are motion files and are ideal for fast previews from *MotionCentral*'s Playback View.

Note: *MotionCentral* supports the viewing of images captured using legacy cameras. Using the Create Film Index option, from the File drop-down list, an *.IDX file can be built by selecting saved images from legacy cameras.



11.8. Convert *.JPG, *.TIFF and *.TY2 images to *.AVI

1. Select File at the top of the *MotionCentral* toolbar.
2. Select Convert Film to AVI from the File drop-down list.
3. From the Open File menu, select the *.IDX of the files to convert. The AVI Setup Dialog box will display.
4. From the Video Compressor drop-down list, select the desired video compression method.
5. Check the No Compression box for full-sized files.
6. Use the Quality slider to select the desired video quality. Selecting a higher percentage number will result in a higher quality image and a larger image size.
7. Under Options, check the Add Border Data to AVI box if you would like *MotionCentral* to add border data to the *.AVI file. Under Destination, select where you would like to save the file.
8. Click OK.



12. Playback

12.1. Overview

MotionCentral can play recorded image sequences from a camera. A camera containing a recorded image displays a film reel icon on the Thumbnail View title bar. Once the Playback window is open, a number of controls are available in addition to those available for a live image. Older cameras (HG, CR, and TX models) can playback a recorded image to an attached video monitor.

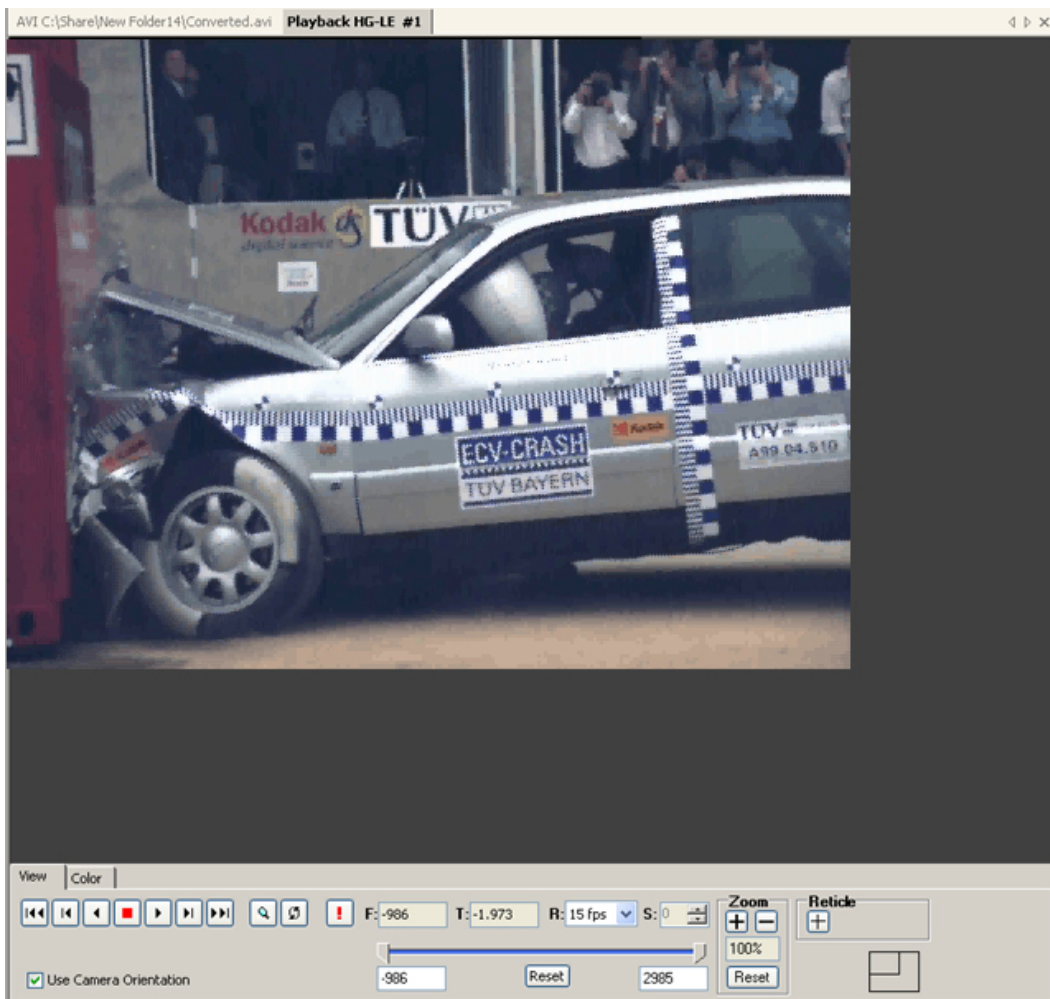


Figure 45: Camera Playback window

12.2. Open an Image for Playback

1. After recording an image, the camera's Thumbnail title bar will display a film reel icon.
2. From the Camera List, double click on the desired camera's Thumbnail view. An image will display in the Camera Playback window. View and Color control tabs will display at the bottom of the Camera Playback window.

12.3. Set Display Controls

1. Select the View tab below the playback window.
2. Click one of the following display option buttons:
 - **Ping-Pong Mode**—repeats image sequence continuously, playing from beginning to end, then backwards from end to beginning.
 - **Continuous Play**—repeats image sequence continuously, playing from beginning to end.
 - **Trigger Frame**—click on this icon and Frame 0, the trigger frame, is displayed.

12.4. Set Frame Position

To display the frame position based on frame number:

1. Select the View tab below the Playback window.
2. Enter the desired frame number in the F box.

To display the frame position based on time relative to the trigger time:

1. Select the View tab below the Playback window.
2. Enter the frame's time stamp relative to the trigger time in seconds.

12.5. Change the Frame Rate

1. Select the View tab below the Playback window.
2. Use the drop-down list to change the frame rate.

12.6. Set the Number of Frames to Skip when Advancing Frames

Defining the number of frames to skip for the Frame Advancing feature makes it possible to skim through the frame sequence faster since frames generally contain redundant information.

1. Select the View tab below the Playback window.
2. Use the up and down arrows to select the number of frames to skip.

12.7. Select Start and End Boundaries

1. Select the View tab below the Playback window.
2. Use the sliders to select and limit the Playback area.

12.8. Set Camera Orientation

1. Select the View tab below the Playback window.
2. Click on the Use Camera Orientation check box to display the image in the same orientation as selected in the System Tab.



12.9. Copy an Image

1. Right click on the image in the playback view. The pop-up menu will display.
2. Select Copy from the pop-up menu. The image in the Playback View window will be copy to the Clipboard.

12.10. Control Border Data Menu Display from the Context Menu

1. Right-click on the image in the Playback View window. A pop-up menu will display.
2. Select Border Data. An additional menu offers the following options:
 - Select Show to enable border data display.
 - Select Hide to disable border data display.
 - Select Fields to open an additional menu and select the border data elements.

Note: This controls the displayed border data for this camera only, for as long as the view remains open.

12.11. Rotate the Image

1. Right-click on the image in the Playback View window. A pop-up menu will display.
2. Select Rotate. An additional menu offers the following options:
 - 90° CW (clockwise, or right)
 - 90° CCW (counter-clockwise, or left)
 - 180° Flip (reflect) Horizontal
 - Flip Vertical
 - Reset command restores the image to its original state.

Note: The rotation option is for display only. The camera will not save rotation changes in the image file.

12.12. Toggle Between Live Image and Reference Image

1. Right-click on the image in the Playback View window. A pop-up menu will display.
2. Select Image. An additional menu offers the following options:
 - **The Open...** command opens a file browser to select a previously saved image to reference against the currently opened image.
 - **The Toggle** command switches the displayed image between the newly opened reference image and the live view currently displayed.
 - **The Continuous Toggle** command toggles the two images at a regular interval using the values set in the System Tab.

12.13. Set the Toggle Rate between Live and Reference Images

1. Select the System Tab on the Control Panel.
2. At the bottom of the System Tab, use the Image Toggle Rate up and down arrows to select the toggle rate in seconds.

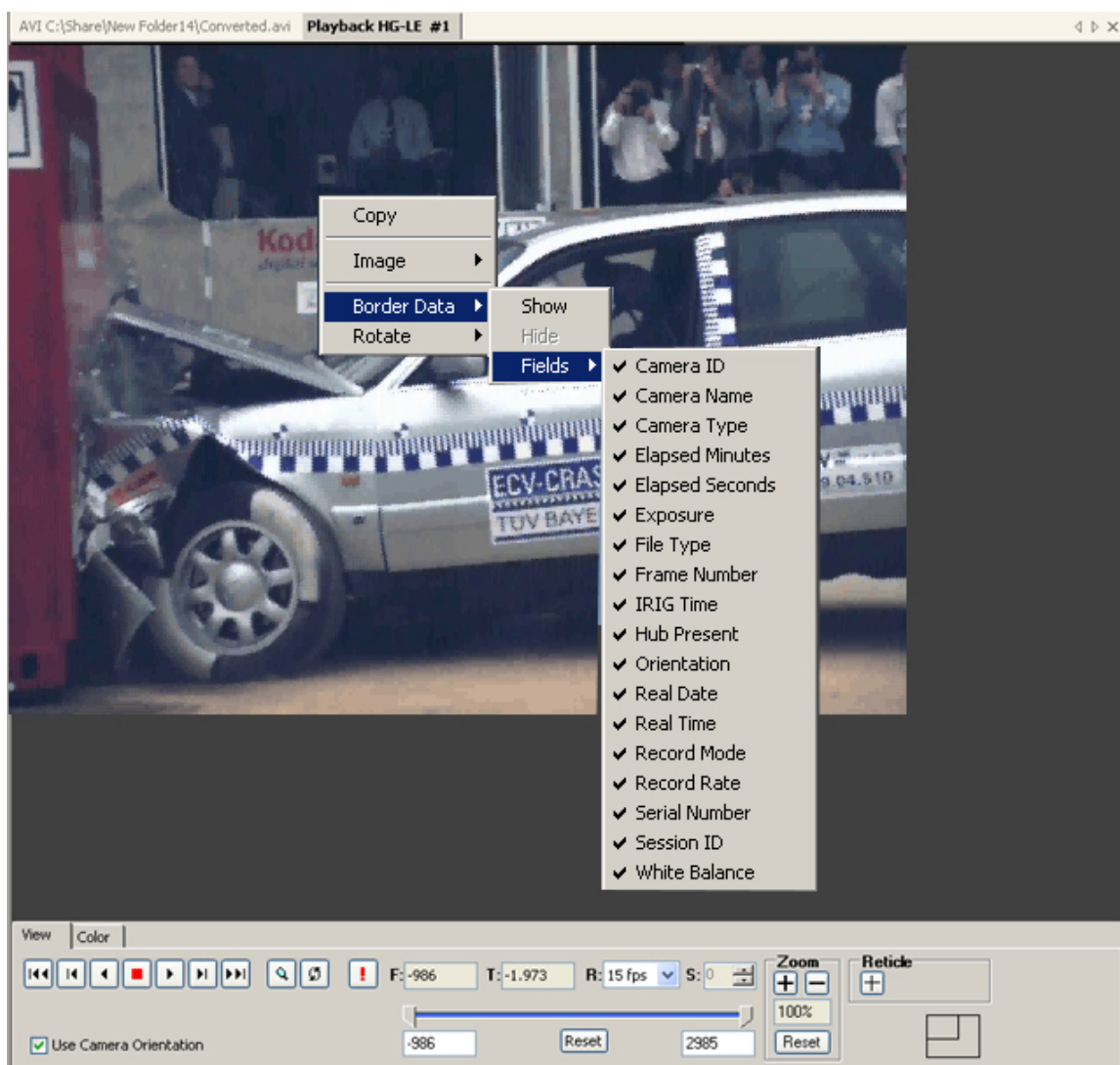


Figure 46: Playback View Window with context menu

12.14. Viewing a Playback Image on an NTSC/PAL Monitor with the HG-TH System

The HG-TH system provides a connection to an NTSC/PAL monitor for viewing images while in Playback. Control the output using the *MotionCentral* software or directly from the Camera Controller.

12.14.1. *Output Playback to an NTSC/PAL Monitor with MotionCentral*

1. Connect one end of the BNC cable to the monitor and connect the other end to the BNC connector below the Head Select button on the HG-TH Camera Controller.
2. From the Camera List, double click on the desired camera's Thumbnail view. An image will display in the Camera Playback window.
3. Click the Play button on the View tab at the bottom of the Playback window.
4. From the Control Panel, select the Video tab.
5. From the drop-down list, select NTSC or PAL video output.
6. From the On Screen Display drop-down list, select one of the following on-screen information options:
 - OFF
 - Time
 - Name and ID
 - Time, Name and ID
7. Click the Video Output On/Off monitor icon to start outputting to the monitor.
8. In multi-Camera Head configurations, click on the Video Output On/Off monitor icon to select a different Camera Head to output to the NTSC/PAL monitor.

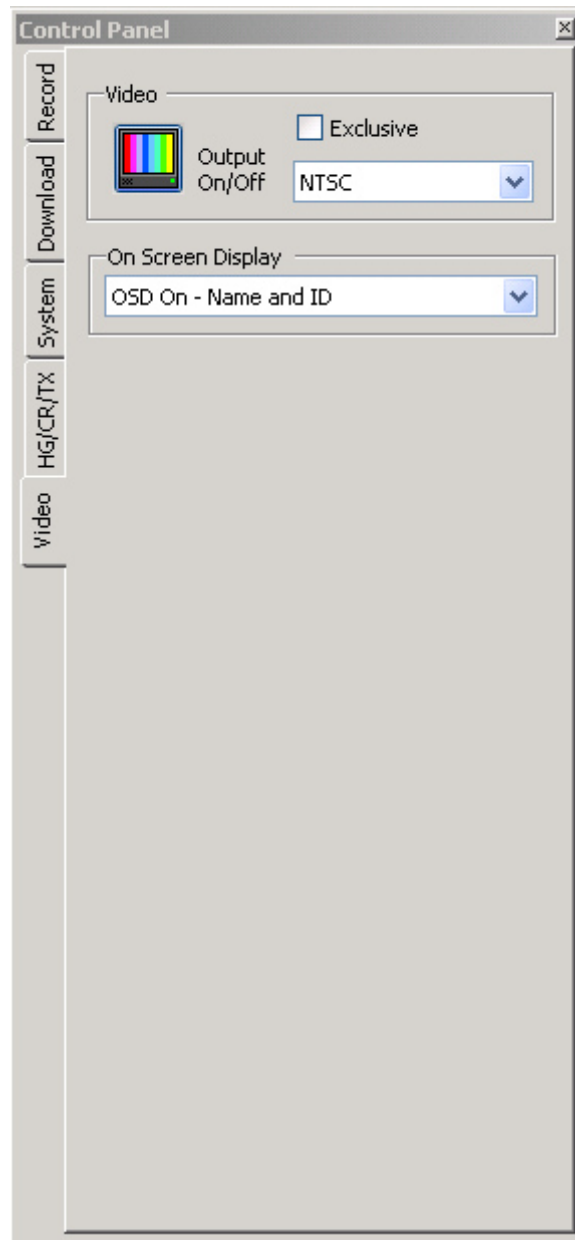


Figure 47: HG-TH Video tab

13. Legacy Cameras

The HG/CR/TX tab on the Control Panel offers controls for Legacy cameras.

13.1. HG/CR/TX Operation

Enable or Disable Video Output NTSC/PAL

1. Select the HG/CR/TX tab on the Control Panel.
2. In the Off-screen section, click on the Output ON/OFF button.
3. Use the drop-down list to select NTSC or PAL video modes.

Enable or Disable Rear Panel Buttons

1. Select the HG/CR/TX tab on the Control Panel.
2. Click on the Rear Panel Lockout button in the Misc. section.

Split Frame

1. Select the HG/CR/TX tab on the Control Panel.
2. Check the Split Frame box to enable or disable.

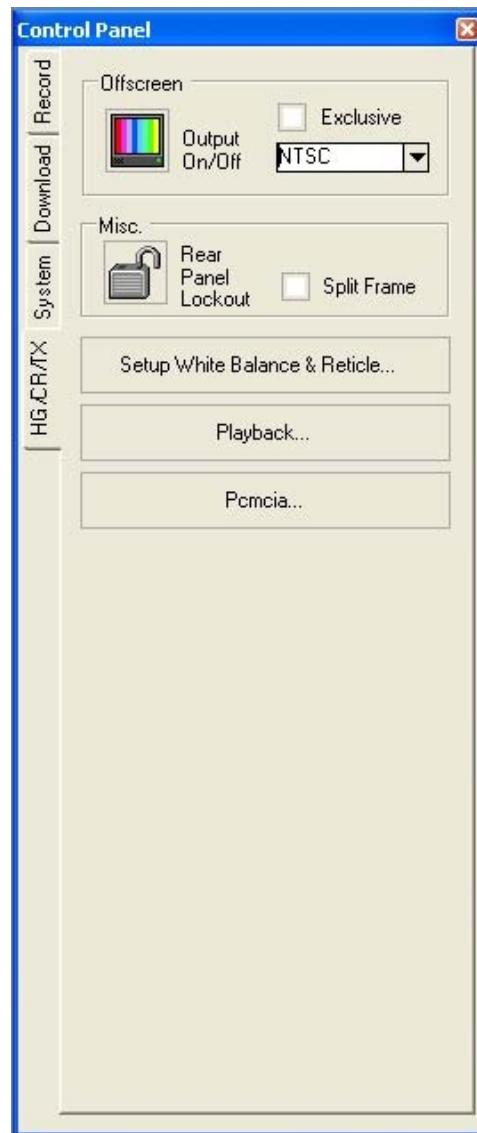


Figure 48: Control Panel: HG/CR/TX Tab

13.2. HG/CR/TX White Balance

The White Balance tab contains controls for movement of the white patch area on the video screen. Clicking any of the four pointers moves the area in the corresponding direction. The setting of the **Coarse** check box determines whether the response to a single pointer click is large or small.

To Correct White Balance:

1. Select the HG/CR/TX tab on the Control Panel.
2. Click on the Setup White Balance and Reticle.
3. Click on the White Balance tab.
4. Select a white or neutral-gray target object in the field of view illuminated by the same lighting that used during recording. A Photographic gray card is ideal.
5. Use the arrows to move the White Balance reticle so that the central box is located completely within the target object.
6. Click the Set button to send the setting to the camera.

A drop-down list box at the bottom of the dialog allows control of the camera's internal white balance setting.

13.3. Activate the Reticle

The **Reticle** tab activates the camera-generated cross hairs on the video monitor.

1. Select the HG/CR/TX tab on the Control Panel.
2. Click on the Set up White Balance and Reticle button.
3. Click on the Reticle tab.

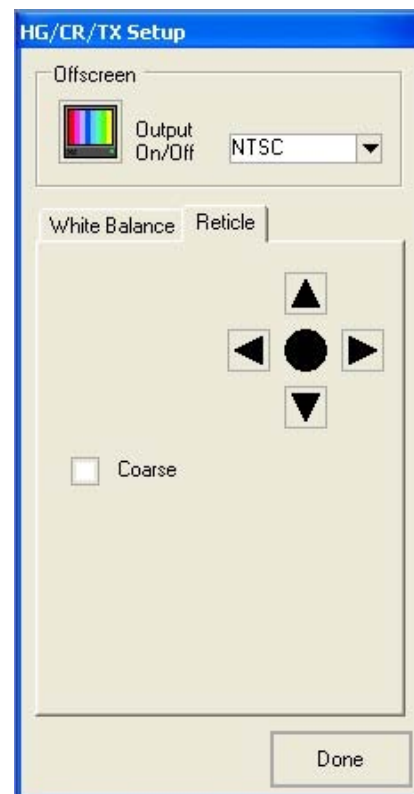


Figure 49: Legacy camera reticle tab

13.4.HG/CR/TX Playback

The Playback button opens a dialog that contains playback controls similar to those on the Live View and File playback windows. The difference is that the image displays on a video monitor physically attached to the camera instead of the computer display.

1. Select the HG/CR/TX tab on the Control Panel.
2. Click on the Playback... button. This dialog box provides playback via a set of control buttons. The playback video is visible on a video monitor attached to the camera or J-D box video BNC.



Figure 50: Playback to monitor

13.5. PCMCIA File System

The PCMCIA button opens a dialog for configuring the PCMCIA file system. Legacy camera models support an internal PCMCIA module for downloading recorded images.

Select Local or Remote Output of Commands

1. Select the HG/CR/TX tab on the Control Panel.
2. Click on the PCMCIA button.
3. Select the Local radio button to direct output to the large text area to the right of the dialog. Select the Remote radio button to direct output to the video monitor.

Directory Settings

1. Select the HG/CR/TX tab on the Control Panel.
2. Click on the PCMCIA button.
3. Use the Directory Settings buttons for the following options:
 - **Change**—changes the current working directory to what is in the text box at the top of the group box.
 - **Create**—creates a directory name.
 - **Delete**—removes the directory.
 - **List**—produces a listing of the contents of the specified directory, either to the text area in the dialog (if Local is selected), or to the attached monitor (if "Remote" was selected).
 - **More**—advances the list as necessary.

Delete Files

Click a file in the text list area to display its name in the File box text area. Click a directory to display its name in the text box.

1. Select the HG/CR/TX tab on the Control Panel.
2. Click on the PCMCIA button.
3. Enter the file name in the Files text box.
4. Click the delete button.

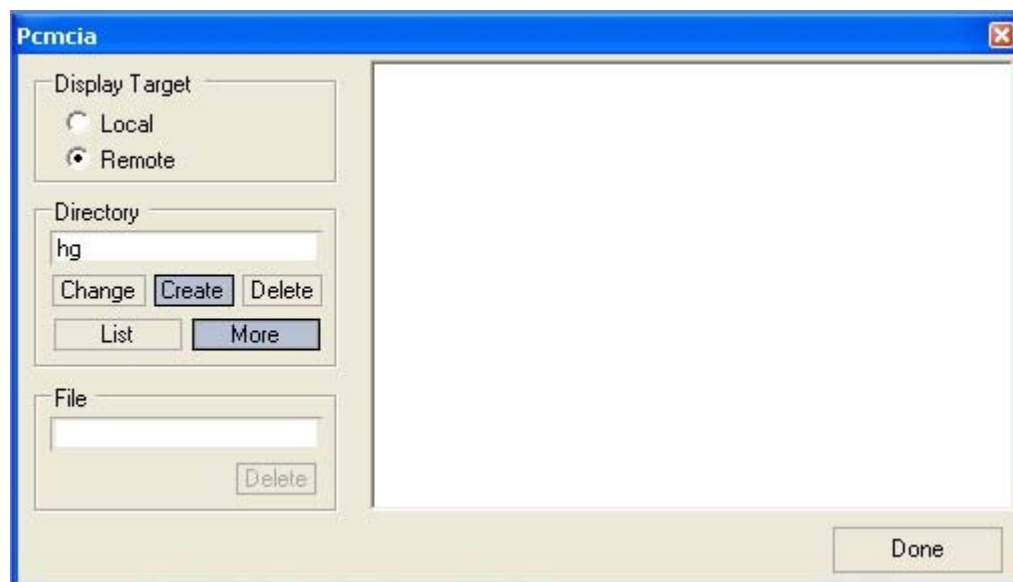


Figure 51: PCMCIA Dialog

Note: Live, Playback and thumbnail images from HG-100K/LE/TH cameras stop, when legacy cameras download images.

14. Appendix A Camera Specifications

14.1. Description

HG-100K, HG-LE and HG-TH are High-G cameras that use a high-performance CMOS sensor. The HG-100K has either 2 GB or 4 GB of memory. The HG-LE has either 1 gigabyte or 2 gigabytes of memory. The HG-TH is configurable with 2 GB to 8 GB of memory. All of the camera systems have a battery backup for retaining images during a power fault for up to six hours. The *MotionCentral* software installed on the CCU/DCU provides all camera control functions.

14.2. Frame Rate/Resolution

The HG-100K is capable of capturing images at user defined resolutions up to 1504 X 1128. The HG-LE is capable of capturing images at resolutions up to 752 x 1128. The HG-TH is capable of capturing images at resolutions up to 752 x 564. The resolutions for the HG-100K are user-definable in increasing increments of 32 pixels horizontally and 8 pixels vertically. The resolutions for the HG-LE are user-definable in increasing increments of 16 pixels horizontally and 8 pixels vertically. The resolutions for the HG-TH are user-definable in increasing increments of 8 pixels horizontally and 4 pixels vertically.

The following is a table showing all possible frame rates and the highest possible corresponding resolutions in three formats.

14.2.1. HG-100K

FPS	~4:3	1:1	~3:1
<1,000	1504 x 1128	1120 x 1120	1504 x 584
2,000	1056 x 792	896 x 896	1504 x 488
3,000	832 x 632	704 x 704	1312 x 432
5,000	640 x 480	544 x 544	992 x 328
10,000	416 x 320	352 x 352	672 x 216
20,000	256 x 192	224 x 224	416 x 136
30,000	192 x 152	160 x 160	320 x 104
50,000	96 x 72	96 x 96	192 x 64
100,000	32 x 24		64 x 24

Table 1: HG-100K Frame Rates and Resolutions

14.2.2. HG-LE

FPS	1:1
1,500	752 x 752
2,000	656 x 656
2,500	576 x 576
3,000	512 x 512
5,000	400 x 400
10,000	256 x 256
20,000	176 x 176
30,000	128 x 128
50,000	64 x 64

Table 2: HG-LE Frame Rates and Resolutions

14.2.3. HG-TH

FPS	1:1
1,000	752 x 564
1,600	512 x 512
1,800	480 x 480
2,000	512 x 408
2,600	480 x 320
3,700	320 x 320
5,000	320 x 240
10,000	256 x 136
30,000	128 x 64
50,000	80 x 40

Table 3: HG-TH frame rates and resolutions

14.3. Frame Storage Capacity

HG-100K

The HG-100K is available with 2 GB of memory as a standard feature and 4 GB optional.

2 GB = 1,264 full frames (1.2 seconds record time at 1000 fps.)

4 GB = 2,528 full frames

Longer record times are possible at resolutions less than 1504 x 1128. In addition, the HG-100K offers the capability for varying the frame rate during the same recording, allowing you to achieve greater record times during a single event.

HG-LE

The HG-LE is available with 1 GB of memory as a standard feature and 2 GB optional.

1 GB = 1,264 full frames

2 GB = 2,528 full frames

HG-TH

A HG-TH system with a two port Camera Controller is available with 2 GB of memory as a standard feature and 4 GB optional. A four port Camera Controller is available with 4 GB of memory as a standard feature and 8 GB optional.

2 GB with two Camera Heads = 2,528 full frames

4 GB with two Camera Heads = 5,056 full frames

8 GB with two Camera Heads = 10,112 full frames

14.4. HG-100K Camera Specifications

Sensor	1504 x 1128 pixels, CMOS
Resolution	1504 x 1128; 8 bits (mono), 24 bits (color) pixel depth
Recording Rates	30, 60, 125, 250, 500, 1000 full fps; up to 100,000 partial fps; variable frame rate via external source
Shutter	Global Electronic Shutter variable from 1/frame rate - 5 μ s
Trigger Frame	Variable position from start to the maximum available frame capacity
Trigger Mode	TTL, 5V-tolerant, user selectable polarity, or switch closure
Synchronization	All cameras are synchronized to a master precision clock
Record Time	Standard: 1.2 sec.@ 1000 full fps; Longer record times possible at slower frame rates and/or reduced resolution
Camera Size	Dimensions: 5.33"(H) x 11.10" (L) x 4.15"(W) (135 x 105 x 282mm); Weight: 11 lbs (5Kg)
Camera Interface	Camera Network (100/1000Base-T Ethernet); Sync I/O; Trigger In; Power; Strobe Out
Cable Lengths	Camera to Hub: up to 328 ft (100m); Hub to Hub/Control PC: up to 328 ft (100m)
Lens Mount	C-mount, F-mount, and High-G mounts available
Hub Size	Dimensions and Weight: 2.16"(H) x 13"(W) x 13" (L) (55 x 330 x 330mm); Weight: 11 lbs (5Kg)
Hub Interface	Camera/Hub/Control PC Network; Trigger I/O; IRIG/GPS Sync In; Sync Out; Power I/O; Legacy Port to connect HG D-Box or HG J-Box for multiple Legacy cameras
Power	Camera: +24 to 50 VDC @ 40W Max.; Hub: +20 to 50 VDC @ 50W Max.
Shock	100G @ 5ms min. any axis, 1000 cycles
Operating Temperature	0°C to + 45°C Ambient (14°F to 113°F)
Control Software	<i>MotionCentral</i> CCU. Windows™ 2000, XP and NT 4.0 SP6 compatible
File Formats	Type-2 Bayer , TIFF, JPEG; 8-bit mono, 24-bit color
Reticle	Full Screen Crosshair with X, Y Coordinate Display
Options	Tablet Style Display Control Unit (DCU)
Emission/Safety	Meets all applicable international standards

Table 4: HG-100K specifications

14.5. HG-100K Camera Sensor Specifications

Sensor Type	Complementary Metal Oxide Semiconductor (CMOS)
Sensor Resolution	1504 x1128 Pixels, each pixel 12 microns square
Readout Sequence	Progressive scan
Shutter Type	Synchronous with variable integration time
Dark Current	330 pA/cm ² at 21°C (69.8°F) – with microlenses and color filters
Dynamic Range	62dB
Fill Factor	45%

Table 5: HG-100K sensor specifications

14.6. HG-LE Camera Specifications

Sensor Array	16-Channel, 752 x 1128 pixels, CMOS Sensor, Color or Monochrome
Image Resolution	Up to 752 x 1128
Dynamic Range	62 dB at sensor and 25°C (77°F) ambient temperature
Recording Rates	30, 60, 125, 250, 500, 1000 full fps; up to 100,000 partial fps; variable frame rate via external source
Shutter	Global Electronic Shutter variable to 5µs
Trigger Frame	Variable position from start to the maximum available frame capacity
Trigger Mode	TTL, 5V-tolerant, user selectable polarity, or switch closure
Synchronization	All cameras are synchronized to a master precision clock when using optional Hub Sync Unit within +/- 2.5 µs
On-Board Storage	1 GB memory storage, 2 GB optional
Camera Size	Dimensions: 5.33"(H) x 4.15"(W) x 11.10" (L) (135 x 105 x 282mm); Weight: 9.9 lbs (4.5kg)
Camera Interface	Camera Network (100/1000Base-T Ethernet); Sync I/O; Trigger In; Power; Strobe Out
Cable Lengths	Camera to Hub: up to 328 ft (100m); Hub to Hub/Control PC: up to 328 ft (100m)
Lens Mount	C-mount, F-mount, and High-G Box-mounts available
HSU Interface	Camera/Hub Sync Unit/Control PC Network; Trigger I/O; Power I/O; Legacy Port to connect HG D-Box or HG J-Box for multiple Legacy cameras (HG2000/HG-100+/CR/HG-TX)
Power	Camera: +24 to 50 VDC @ 40W; Hub: +20 to 50 VDC @ 50W
Shock	Camera and Hub: 100G @ 5ms min. any axis, 1000 cycles
Operating Temp.	0°C to +45°C Ambient (32°F to 113°F)
Control Software	<i>MotionCentral™</i> Windows™ 2000, XP and NT 4.0 SP6 compatible
File Formats	Type-2 Bayer, TIFF, JPEG; 8-bit mono, 24-bit color
Reticle	Full Screen Crosshair with X, Y Coordinate Display
Options	Tablet Style Display Control Unit (DCU)
Emission/Safety	CE approved, FCC Class B compliant, UL recognized (camera), UL listed (Hub Sync Unit)

Table 6: HG-LE specifications

14.7. HG-LE Sensor Specification

Sensor Type	Complementary Metal Oxide Semiconductor (CMOS)
Sensor Resolution	1128 x 752 Pixels, each pixel 12 microns square
Readout Sequence	Progressive scan
Shutter Type	Synchronous with variable integration time
Dark Current	330 pA/cm ² at 21°C (69.8°F) – with microlenses and color filters
Dynamic Range	62dB
Fill Factor	45%

Table 7: HG-LE sensor specifications

14.8. HG-TH Camera Specifications

Sensor Array	8-Channel, 752 x 564 pixels, CMOS Sensor, Color or Monochrome
Image Resolution	Up to 752 x 564 at 1000 fps
Dynamic Range	62 dB at sensor and 25°C (77°F) ambient temperature
Recording Rates	Selectable, 25 to 10,000 fps in 5 fps increments; variable frame rate via external source
Shutter	Global Electronic Shutter variable to 5µs
Trigger Frame	Variable position from start to the maximum available frame capacity
Trigger Mode	TTL, 5V-tolerant, user selectable polarity, or switch closure, variable debounce delay
Synchronization	All cameras are synchronized to a master precision clock when using optional Hub Sync Unit within +/- 2.5 µs
On-Board Storage	2 GB, 4 GB, 8 GB memory storage
Camera Size	Camera Head Dimensions: 3.74"(H) x 3.74"(W) x 2.68" (L) (95 x 95 x 68mm); Weight: 2.75 lbs (1.25kg) Camera Controller Dimensions: 6.61" (H) x 3.70" (W) x 7.95" (L) (168 x 94 x 202 mm); Weight 9.5 lbs (4.3 kg)
Tethered Cable	3m, 6m and 10m length at 8mm,9mm, and 10mm diameter respectively
Camera Interface	Camera network (100/1000Base-T Ethernet); Sync I/O; Trigger In; Power; Strobe Out
Controller Cable Lengths	Camera to hub/PC: up to 328 ft (100m); Hub to Hub/Control PC: up to 328 ft (100m)
Lens Mount	C-mount and High-G box-mounts available
HSU Interface	Camera/Hub Sync Unit/Control PC Network; Trigger I/O; Power I/O; Legacy Port to connect HG D-Box or HG J-Box or D-Box for multiple Legacy cameras (HG2000/HG-100+/CR/HG-TX)
Power	Camera: +24 to 50 VDC @ 40W; Hub: +20 to 50 VDC @ 50W
Shock	Camera and Hub: 100G @ 5ms min. any axis, 1000 cycles
Operating Temp.	0°C to +40°C Ambient (32°F to 104°F)
Control Software	<i>MotionCentral™</i> Windows™ 2000, XP and NT 4.0 SP6 compatible
File Formats	Type-2 Bayer, TIFF, JPEG; 8-bit mono, 24-bit color
Reticle	Full screen crosshair with X, Y coordinate display
Options	Tablet Style Display Control Unit (DCU)

Table 8: HG-TH specifications

14.9. HG-TH Sensor Specification

Sensor Type	Complementary Metal Oxide Semiconductor (CMOS)
Sensor Resolution	752 x 564 pixels, each pixel 12 microns square
Readout Sequence	Progressive scan
Shutter Type	Synchronous with variable integration time
Dark Current	330 pA/cm ² at 21°C (69.8°F) – with microlenses and color filters
Dynamic Range	62dB
Fill Factor	45%

Table 9: HG-TH sensor specifications

14.10. HG-100K/LE Camera Dimensions and Mounting Instructions

There are five 1/4-20 threaded holes in the bottom plate of the camera. Four of the holes are in a standard rectangular configuration for attaching a small mounting plate and the fifth hole is for a conventional tripod mount.

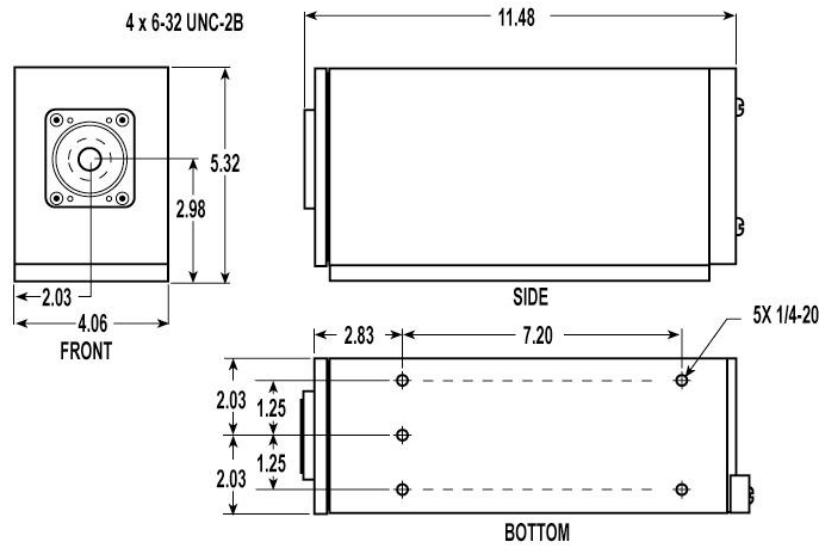


Figure 52: HG-100K/LE dimensions and mounting holes (units in inches)

14.11. HG-TH Camera Controller Dimensions and Mounting Holes

There are four 1/4-20 threaded mounting holes in the wide surface plate of the Camera Controller and four 1/4-20 threaded mounting holes in the small end surface plate opposite the connectors. The most reliable mounting position for High-G environments is to mount the Camera Controller with the wide end attached to the surface and the connectors facing opposite direction of the impact. When mounting the Camera Controller upright with the small end plate connected to a surface, use brackets to help stabilize it.

The HG-TH Camera Controller has optional rubber feet and a 12mm heat sink device attached. For more information, see [Controller Heat Sink Device](#)

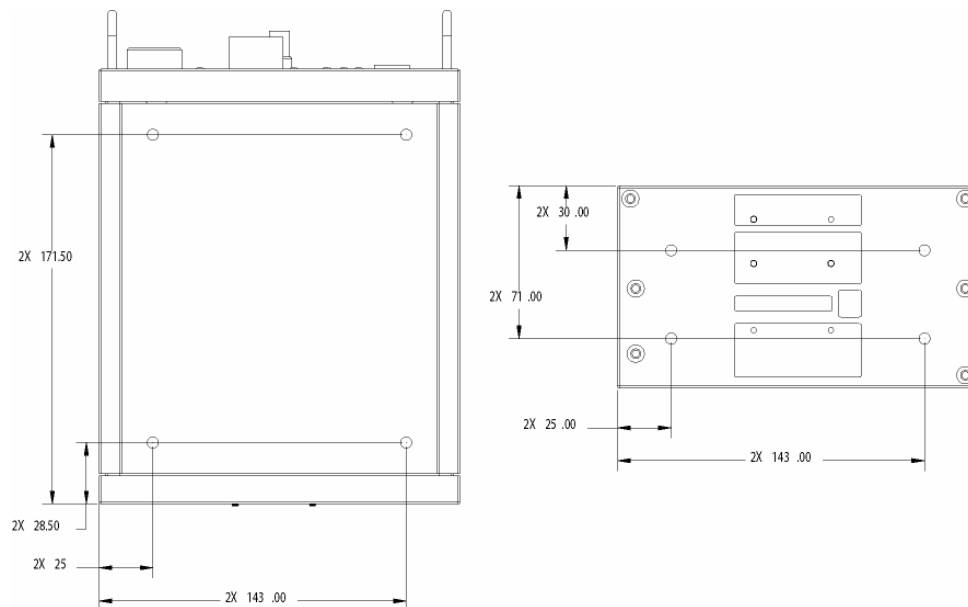


Figure 53: HG-TH Controller mounting holes and dimensions (units in inches)

14.12. HG-TH Camera Head Dimensions and Mounting Instructions

There are four 1/4-20 threaded mounting holes and four M4X0 mounting holes on the front plate of the Camera Head. There are two M4X0 mounting holes on each side of the Camera Head. The most reliable method for mounting the Camera Head in a High-G environment is to use at least four holes to connect the head to the surface.

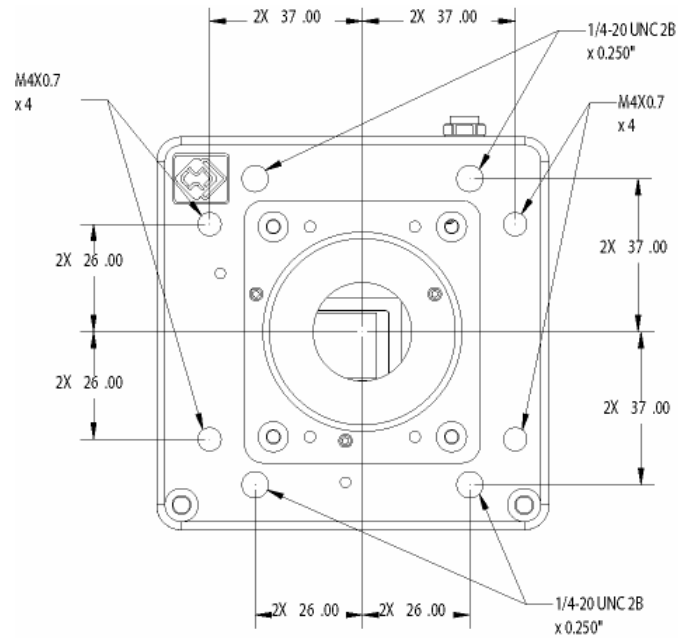


Figure 54: HG-TH Camera Head dimension and mounting holes front view (units in inches)

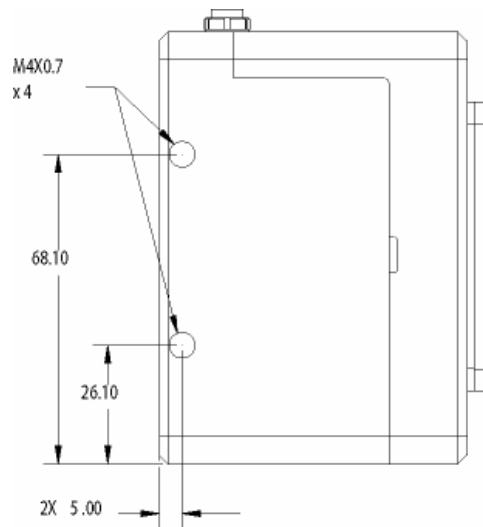


**Figure 55: HG-TH Camera Head dimensions and mounting holes side view
(units in inches)**

14.13. HG-100K/LE Lithium Ion Battery Specifications

Nominal Capacity		650mAH
Nominal Voltage		3.7V
Charging Method		Constant Current-Constant Voltage
Charging Voltage		4.2V
Charging Current		650mA
Charging Time		2.5 hours
Weight		19 g
Dimensions (w/Tube)	(D)	14.2mm
	(H)	49.3mm

Table 10: HG-100K/LE Backup battery specifications

14.14. HG-TH Lithium Ion Battery Specifications

Nominal Capacity		2000 mAH
Nominal Voltage		3.6 V
Charging Method		Constant Current-Constant Voltage
Charging Voltage		4.2 V
Charging Current		1190 mA
Charging Time		2 hours
Weight		43 g
Dimensions (w/Tube)	(D)	18.5 mm
	(H)	65 mm

Table 11: HG-TH Backup battery specifications

15. Appendix B Hub Sync Unit (HSU) Specifications

15.1. HSU Specifications

DC Power Connector	ITT Cannon, Mil-Spec, 8-pin, circular
Ethernet Connector	RJ-45, hardened to withstand High-G environment
Sync/Trigger/Pwr Connector	18-Pin High-G Connector
Trigger Input Connector	BNC
IRIG Clk Connector	BNC (not implemented)
IRIG Trig Connector	BNC (not implemented)
HG J/D Box	26-Pin High-G Connector
Size	Dimensions: 13.0"(H) x 13.0" (W) x 0.89"(D) (330 x 330 x 22.6mm); 11 lbs (5Kg)
Weight	11.8 lbs (5.35Kg)
Power	20 to 50 VDC input, 30 VDC out to camera
Shock	100G @ 5ms min. any axis, 1000 cycles
Temperature	Operating: -10 to 45°C (14 to 113°F) Non-Operating: -25 to 65°C (-13 to 149°F)
Humidity	Operating: Maximum is 80%, non-condensing, at 45°C (113°F) for 8 hours. Non-Operating: Maximum is 40%, non-condensing, at 65°C (149°F) for 48 hours.
Altitude	Operating: Maximum is 3,048 m (10,000 feet) with an ambient temperature of 0 to 25°C (32 to 77°F). Non-Operating: Maximum is 15,240 m (50,000 feet).

Table 12: HSU specifications

15.2. HSU Mounting Dimensions

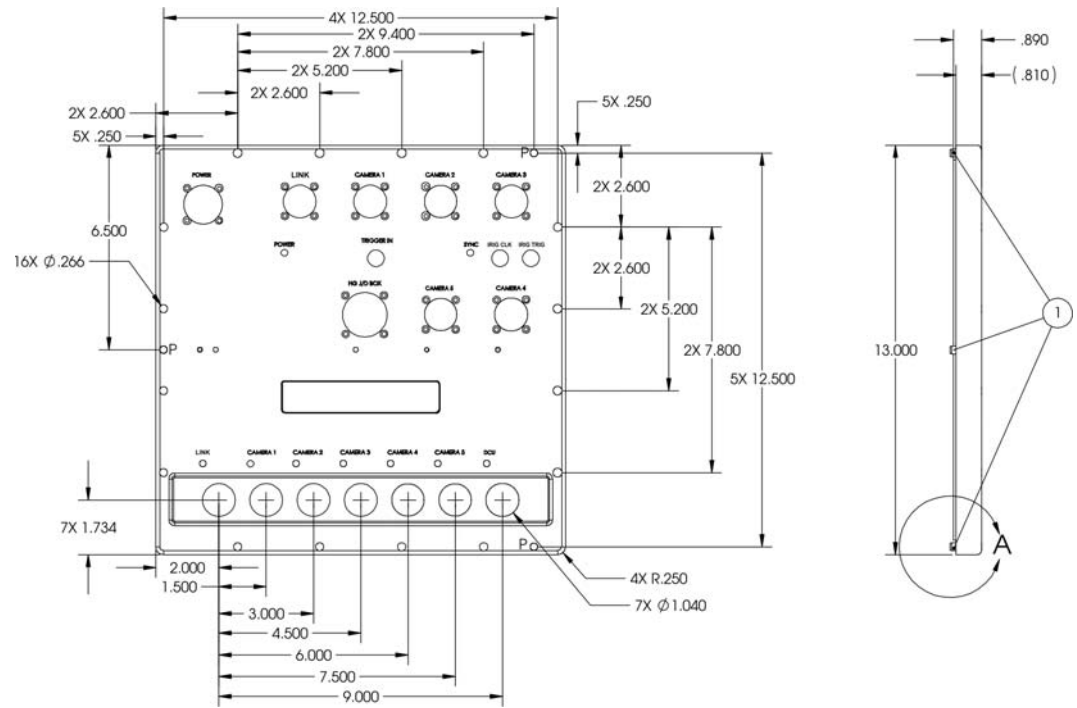


Figure 56: HSU mounting dimensions (units in inches)

15.3. HSU and Synchronization

The root hub manages the distribution of synchronization and trigger signals to the cameras, hubs, and legacy boxes. All of the devices in the camera network synchronize with the root hub. The root hub is the hub at the top of a fan-out tree distribution, and has a Root Hub Cap which screws on to the upper Link port on the hub. The root hub originates a sync signal with encoding for frame synchronization, time stamping, and triggering of the camera array.

If a HSU loses the root hub sync signal, the sync signal generated at the hub indicates a loss of sync with the Root Hub and each camera will tag its subsequent image files with a loss of sync marker that displays in the border data.

A hardware trigger can be received anywhere on the network, camera or HSU. If the trigger connects to the camera or the Hub, it propagates back to the Root Hub via the Trigger Return signal for encoding onto the sync signal.

Note: In systems with multiple cameras connected through HSUs, connect and power up before placing any camera in ready state. Connecting additional cameras to the HSU may inadvertently trigger previously connected cameras.

15.4. HSU Legacy Port

The HG-100K/LE/TH HSU has an integrated legacy D- or J-Box port designed to support the use of older HG, HG-TX, and CR cameras.

The Legacy Communications (COM) Cable is required to connect the D- and J-Boxes to the HG-100K/LE/TH HSU. It attaches to the Output connector on the J- or D-Box and the other end to the HG J/D Box connector. Camera commands, Trigger, and Sync (at 1000FPS) transfer over this communication/data link between the CCU and the Legacy cameras.

The HG-100K/LE/TH HSU does **NOT** provide power to Legacy cameras and J/D boxes. The J/D boxes connect to their own power supplies.

A 1 KHz sync signal is active on the Legacy Port of the HSU. If Legacy cameras are set to External mode when in record, it will receive a 1 KHz pulse that is frame synchronized with the HG-100K/LE/TH camera, regardless of HG-100K/LE/TH frame rate.

15.5.DCU Specifications

Fujitsu Stylistic® ST4000 Series Tablet PC

Processor	Ultra-Low Voltage Mobile Intel® III processor 800 MHz – M which supports enhanced Intel® SpeedStep technology; 512KB on-die L2 cache; 133MHz system bus speed
Display	10.4" XGA TFT, indoor viewable
Digitizer	Electromagnetic (Active)
Memory	256 MB onboard, one DIMM slot available; maximum memory to 768 MB (512MB x 1)
Hard Drive	20 GB Ultra DMA 100, shock-mounted hard disk drive
Video Controller	Integrated Intel Direct AGP Graphics with up to 48MB Dynamic Video Memory Technology
Operational Temperature	Operating Temperature (with power management): 41° to 95°F (5° to 35°C)
Humidity	Operating: 20% to 85% (non-condensing); Non-operating: 8% to 85% (non-condensing)
Storage Temperature	5° to 140°F (-15° to 60°C)
Communications	Multinational ¹ 56K ² V.90 modem, 10/100 Base-TX Ethernet, and optional wireless LAN (802.11b)
Ports	Two USB 1.1, Infrared port (IrDA 1.1-compatible, 4 Mbps), external monitor, modem (RJ-11), Ethernet (RJ-45), IEEE 1394, and system interface connector
PC Card Slot	One Type I or Type II slot; 32-bit PC CardBus architecture
Battery ⁴	Lithium ion; 6-cell 10.8V, 4000mAh; Up to 4.5 hours using main battery
Power	AC Adapter -- Auto-sensing dual voltage support, 100-240V AC; DC 16V, 3.75A
Dimensions	11.86"(h) x 8.66"(w) x .82-.88"(d)
Weight	Approximately 3.2 lbs
Operating System	Microsoft® Windows® XP Tablet PC Edition
Agency Approval	Emissions: EN55022 (CISPR22) Class B; FCC 15, Class B; FCC15C, 15.247; EN 300-328; ICES-003; Canada RSS-210 Immunity: EN55024 (1998); EN 301-489-17 V.1.1.1 (2000-9) Safety: UL and cUL Listed, UL 1950, 3rd edition; TuV T-Mark, EN60950 Telecom: FCC Part 68; IC CS-03
Warranty	Fujitsu one-year or three-year International Limited Warranty ³ ; 24/7 technical support

Table 13: DCU Specifications

1) The internal modems on all Fujitsu pen tablet PCs from Fujitsu PC Corporation are only qualified for use with telephone systems in selected countries, including the United States and Canada. For a list of certified countries, please check www.fujitsupc.com/modems.

2) Actual speeds over U.S. telephone lines vary, and are less than 56Kbps due to the current FCC regulations and line conditions.

3) Service and warranty turnaround time may vary by country and product. International warranty valid only for products purchased in North, Central, and South America.

4) Battery life estimates reflect the results of Ziff Davis Business Winstone 2001 BatteryMark 1.0 as performed upon systems with maximum battery life settings enabled. Actual battery life will vary based on screen brightness, applications used, features selected, power management settings, battery conditioning, and other customer preferences.

16. Appendix C Connectivity/Connector Function

16.1. Network Connectors

The following network connectors are on the rear panel of the camera or Camera Controller:

- One ruggedized RJ-45 connector for 100/1000Base-T communications.
- One standard RJ-45 connector for 100Base-TX communication with the DCU for image display during focus and set up of the camera. This connector is not High-G rated and is not intended for use during High-G events.

16.2. HG-TH Composite Video Output BNC

The HG-TH Camera Controller connects to a NTSC/PAL monitor to output composite video in Live View mode or Playback mode.

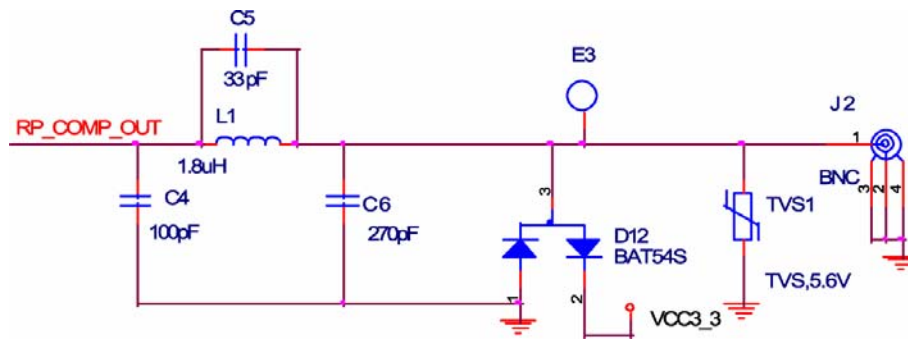


Figure 57: HG-TH composite video out BNC

16.3. Configurable Connector

This LEMO connector is software configurable. Select one of the following options:

- **External Frame Sync Input**—synchronizes frame timing with an external clock. Frame rates less than 1 Hz may compromise Image quality.
- **ROC** (Record on Command)—the camera saves images into memory for the interval that the configurable input is held true and idles when configurable input is untrue – in other words separate and distinct sequences of images can be saved until the memory is full.
- **BROC** (Burst Record on Command)—each time the configurable input becomes true, the camera will save a predefined number (burst) of frames to memory, until the memory is full.
- **Ready/Record**—is a hardwired record button. The camera will record when the configurable input goes true. When the camera is in the Ready mode, the camera is recording pre-trigger frames into the buffer and is waiting for a trigger.

Note: This is a TTL compatible input (0-5VDC). Always check the voltage on the trigger line before connecting to the camera. Signal levels above 5 volts at the Sync in and Trigger in TTL inputs can cause permanent damage to the system.

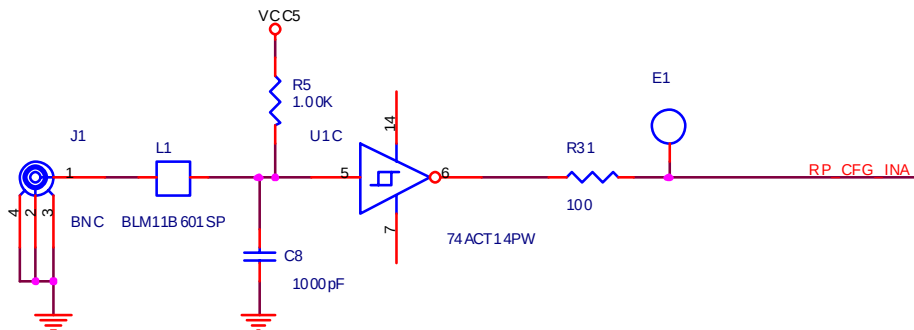


Figure 58: HG-100K/LE Configurable input (Sync In) LEMO connector

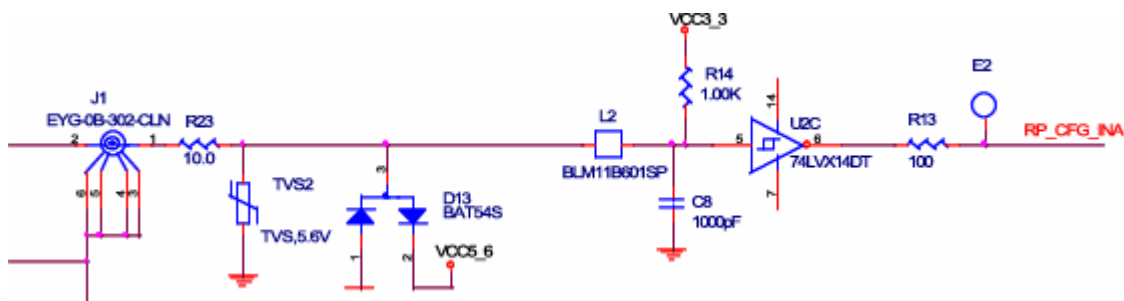


Figure 59: HG-TH Configurable input (Sync In) LEMO connector

16.4. Trigger Input Connector

Using a LEMO connector, the Trigger Input has a programmable polarity. The trigger may be a positive-going pulse, a negative-going pulse or a switch closure. Threshold voltage for positive going system is 2.4 VDC. The threshold for a negative going system is below 0.8 VDC.

Note: This is a TTL compatible input (0-5 VDC). Always check the voltage on the trigger line before connecting to the camera. Signal levels above 5 volts at the Sync in and Trigger in TTL inputs can cause permanent damage to the system.

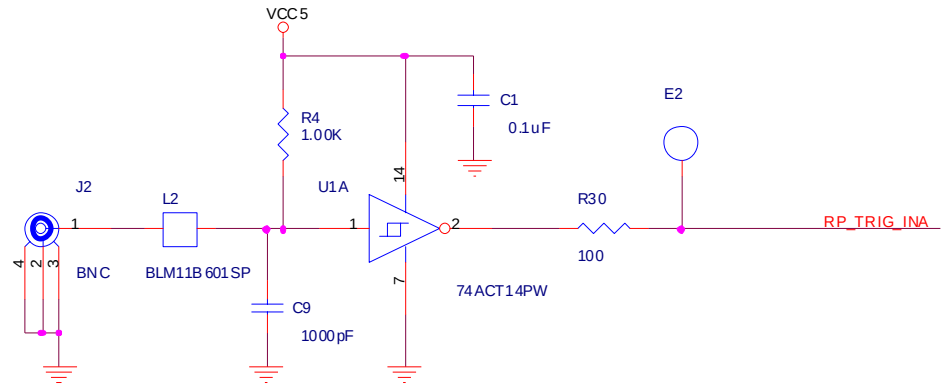


Figure 60: HG-100K/LE Trigger-Input LEMO Connector

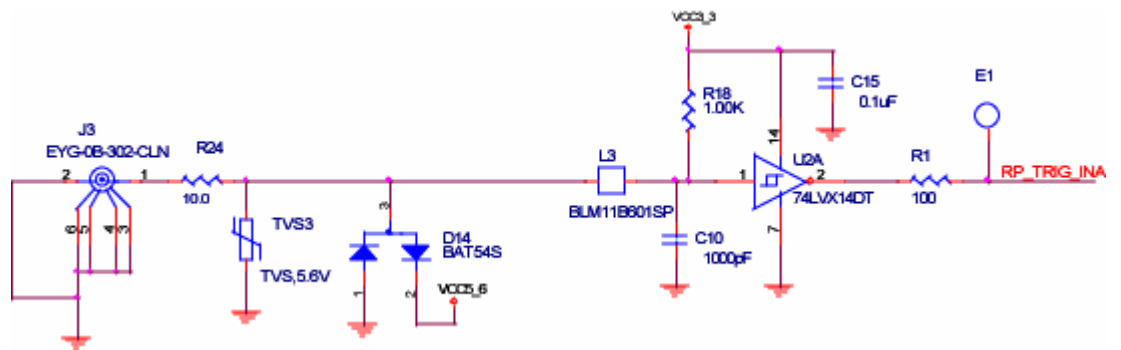


Figure 61: HG-TH Trigger-Input LEMO Connector

16.5. Strobe Output Connector

The Strobe Output generates pulses that synchronize the timing of a strobe (or other peripheral device) with the camera's exposure. It may be either a positive-going pulse, or a negative-going pulse. The pulse can be set with precision to occur any time from 100 μ s before the beginning of exposure up to 5 μ s before the end of exposure.

Note: This is a TTL compatible input (0-5VDC). Always check the voltage on the trigger line before connecting to the camera. Signal levels above 5 volts at the Sync in and Trigger in TTL inputs can cause permanent damage to the system.

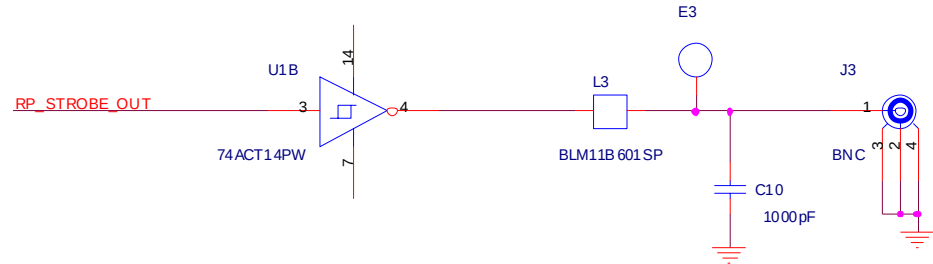


Figure 62: HG-100K/LE Strobe out LEMO connector

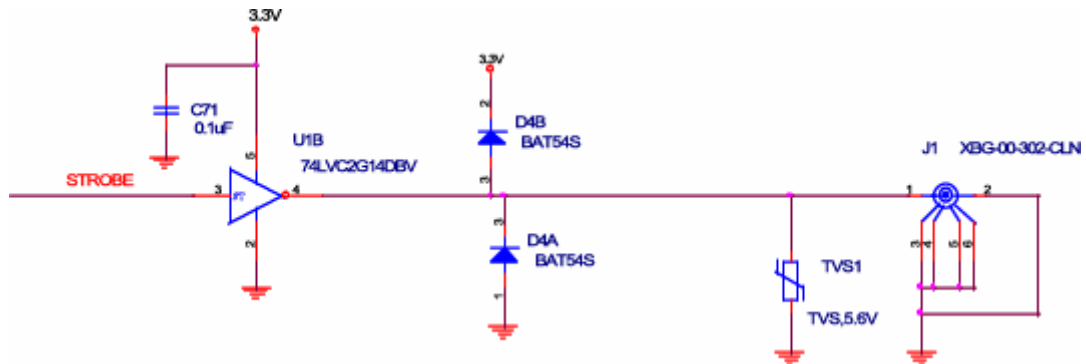


Figure 63: HG-TH Strobe out LEMO connector

Appendix D Image File Formats

The HG-100K/LE/TH is capable of outputting three image file types: TIFF, JPEG, and Type-2. The TIFF file format is uncompressed, while the JPEG file format uses standard JPEG compression. Both TIFF and JPEG file format include the common border data in the image file header, as defined in the following table.

Type-2 files use the RAW image file data appended with the common border data, which is located at the *end* of the file data as defined in the following table.

The following Common Border Data Format definition employs a language-independent offset / size / type / content description format. All numeric multi-byte fields are in **network byte order** (big-endian).

Name	Offset	Size	Type	Description
Common.FileSignature	0	8	char[8]	"HG-100K" + trailing NULL
Common.VideoType	8	1	enum	Color = 1, Mono = 2, Unknown = 0
Common.SessionID	9	1	uint8	0 thru 255
Common.CameraID	10	1	uint8	0 thru 255 (default = 1)
Common.RecordRate	11	1	enum	0 = Unknown, 1 = 30 fps, 2 = 60 fps, 3 = 125 fps, 4 = 250 fps, 5 = 500 fps, 6 = 1 K fps, 7 = 2 K fps, 8 = 3 K fps, 9 = 5 K fps, 10 = 10 K fps, 11 = 50 K fps, 12 = 100 K fps
RESERVED	12	1	N/A	RESERVED
Common.RecordMode	13	1	enum	0 = Record, 1 = Stop, 2 = Trigger, 3 = Trigger2
Common.WhiteBalance	14	1	enum	0 = Daylight, 1 = Tungsten, 2 = HMI, 3 = User, 4 = Unity (all ones)
Common.LightSource	15	1	enum	0 = Daylight, 1 = Tungsten, 2 = HMI, 3 = User, 4 = Unity
Common.McdIPresent	16	1	enum	0 = Absent, 1 = Present
Common.IrigPresent	17	1	enum	0 = Absent, 1 = Present
Common.WhiteBalanceCoefs.Red	18	4	float	IEEE-768, in network byte order
Common.WhiteBalanceCoefs.Green	22	4	float	IEEE-768, in network byte order
Common.WhiteBalanceCoefs.Blue	26	4	float	IEEE-768, in network byte order
Common.FrameNumber	30	2	int16	Signed, relative to trigger frame (16-bit version of Hg100k.FrameNumber)
Common.IsTriggerFrame	32	1	enum	0 = NOT trigger frame, 1 = IS trigger frame
Common.RealTimeDate.Seconds	33	1	BCD	Upper nibble is 10s, lower is 1s
Common.RealTimeDate.Minutes	34	1	BCD	Upper nibble is 10s, lower is 1s
Common.RealTimeDate.Hours	35	1	BCD	Upper nibble is 10s, lower is 1s
Common.RealTimeDate.Day	36	1	BCD	Upper nibble is 10s, lower is 1s
Common.RealTimeDate.Month	37	1	BCD	Upper nibble is 10s, lower is 1s
Common.RealTimeDate.Year	38	1	BCD	Upper nibble is 10s, lower is 1s
Common.IrigTime.Day100s	39	1	uint8	0 thru 3
Common.IrigTime.Day10s	40	1	uint8	0 thru 9
Common.IrigTime.Day1s	41	1	uint8	0 thru 9 (0 thru 366 with above)
Common.IrigTime.Hour10s	42	1	uint8	0 thru 2
Common.IrigTime.Hour1s	43	1	uint8	0 thru 9 (0 thru 59 with above)
Common.IrigTime.Minute10s	44	1	uint8	0 thru 5
Common.IrigTime.Minute1s	45	1	uint8	0 thru 9 (0 thru 59 with above)
Common.IrigTime.Second10s	46	1	uint8	0 thru 5
Common.IrigTime.Second1s	47	1	uint8	0 thru 9 (0 thru 59 with above)
Common.IrigTime.Microseconds	48	4	uint32	0 thru 999,999
Common.ElapsedTime.Minutes	52	2	int16	Signed, relative to trigger time.
Common.ElapsedTime.Microseconds	54	4	int32	Signed, relative to trigger time.
Common.MdclData	58	60	uint16[30]	UNUSED
RESERVED	118	1	N/A	RESERVED
Common.Exposure	119	4	uint32	23 thru 33330 μ s
Hg100k.InterfaceZone	123	4	uint32	Always zero
Hg100k.BorderDataFormat	127	1	enum	0 = HG/CR/TX, 100 = HG-100K
Hg100k.CameraName	128	51	char[51]	A null-terminated ASCII text string
Hg100k.SessionName	179	51	char[51]	A null-terminated ASCII text string
Hg100k.FirstPixelType	230	1	enum	0 = Red, 1 = Blue, 2 = Green on a Red Row, 3 = Green on a Blue Row
Hg100k.SerialNumber	231	4	uint32	Must match camera label

Name	Offset	Size	Type	Description
Hg100k.SensorActiveArea.x	235	2	uint16	32 thru 1504 by steps of 32
Hg100k.SensorActiveArea.y	237	2	uint16	8 thru 1128 by steps of 8
Hg100k.PipelineState	239	4	uint32 (bit vector)	Root Hub Absent = 0x00008000 All other bits are RESERVED, and may have arbitrary values.
Hg100k.EdgeEnhancement	243	1	enum	0 = None, 1 = 0.5, 2 = 1.0, 3 = 1.5, 4 = 2.0
Hg100k.ColorCorrectionMatrix.R0C0	244	4	Radix16	16.16 fixed point (/ 65536.0)
Hg100k.ColorCorrectionMatrix.R0C1	248	4	Radix16	16.16 fixed point (/ 65536.0)
Hg100k.ColorCorrectionMatrix.R0C2	252	4	Radix16	16.16 fixed point (/ 65536.0)
Hg100k.ColorCorrectionMatrix.R1C0	256	4	Radix16	16.16 fixed point (/ 65536.0)
Hg100k.ColorCorrectionMatrix.R1C1	260	4	Radix16	16.16 fixed point (/ 65536.0)
Hg100k.ColorCorrectionMatrix.R1C2	264	4	Radix16	16.16 fixed point (/ 65536.0)
Hg100k.ColorCorrectionMatrix.R2C0	268	4	Radix16	16.16 fixed point (/ 65536.0)
Hg100k.ColorCorrectionMatrix.R2C1	272	4	Radix16	16.16 fixed point (/ 65536.0)
Hg100k.ColorCorrectionMatrix.R2C2	276	4	Radix16	16.16 fixed point (/ 65536.0)
Hg100k.FrameNumber	280	4	int32	-1,864,134 thru 1,864,134 (approx.)
Hg100k.TimeSincePriorFrame	284	4	uint32	Microseconds
Hg100k.FrameFormat	288	1	enum	0 = RGB, 1 = Type-2, 2 = JPEG
Hg100k.ImageSize.x	289	2	uint16	Post crop/decimate
Hg100k.ImageSize.y	291	2	uint16	Post crop/decimate
Hg100k.MaxPixelValue	293	2	uint16	Always 255
Hg100k.BlackOffset	295	2	uint16	Always 0
Hg100k.PixelEncoding	297	1	enum	0 = 2 nd order, 1 = linear
Hg100k.Gamma	298	1	fp8	4.4 fixed point (divide by 16.0)
Hg100k.JpegRestartInterval	299	2	uint16	See PM-36 Data Sheet
Hg100k.JpegQualityFactor	301	2	uint16	See PM-36 Data Sheet
Hg100k.ExpandPixels	303	512	uint16[256]	8-to-16-bit LUT, reverses PixelEncoding to generate 16-bit linear pixels. N/A for JPEG, use three times for RGB.
Hg100k.ExtendedFrameRate	815	4	uint32	Frame Rate, in frames per second.
Hg100k.AncillaryData	819	32	uint8[32]	User-supplied data. Image slider location data.
Hg100k.CameraOrientation	851	2	uint16	User-supplied data. 0000 = upright 005A = right side 00B4 = upside down 010E = left side
Hg100k.TimeZeroReference	853	1	uint8	01=Timestamps referenced to Trigger time. 02=Timestamps referenced to Frame Zero start of exposure.
Hg100k.TimestampOffset	854	4	int32	Signed offset added to a frame's timestamp.
Hg100k.TriggerDebounceTime	858	4	uint32	Trigger debounce delay.
RESERVED AREA	862	158	uint8[158]	Always zero
EndOfBorderData	1020	4	char[4]	4 ASCII chars = "EoBD" (End of Border Data) = 0x456F4244 integer

Table 14: Common border data format

17. Appendix E Maintenance, Technical Support, Warranty

17.1. Maintenance

The battery is the only user replaceable part inside the camera. Return all cameras to the factory or a Redlake-authorized repair center for repair if a malfunction occurs.

Use dust free compressed air to clean the lens.

Clean the exterior of the camera with a soft, dry, lint-free cloth. For stubborn dirt, dampen the cloth with a mild soap solution.

The backup battery contains Lithium Ion. Handle it with caution to prevent injury to either personnel or equipment. To remove the battery, locate the battery compartment on the camera and remove the two screws holding the cover plate in place. Carefully disconnect the battery and remove it from the compartment. If installing a new battery, ensure that it is an approved replacement battery before installing. With the cover plate removed, connect the replacement battery and position it in the compartment so that it fits without interference. Replace the cover plate and tighten the screws.

WARNING!

The battery pack contains small amounts of harmful substances. To prevent explosion, do not expose to fire or water, short-circuit or disassemble. Do not put batteries in trash that is disposed of in landfills. Replace with approved replacement batteries only. When disposing of depleted batteries, comply with local ordinances or regulations and your company's safety standards.

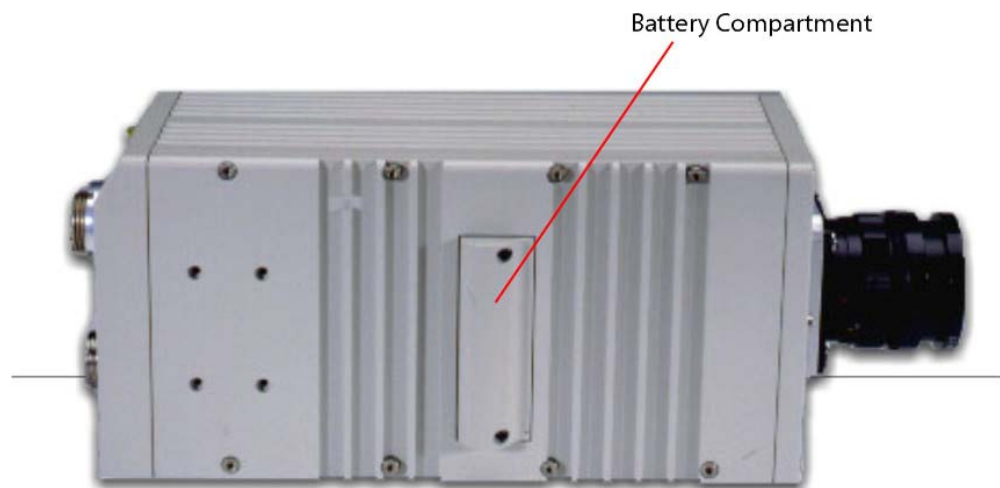


Figure 64: Backup battery compartment

17.2. Technical Support

In the USA

Telephone: 1-800-854-7006 (USA and Canada only)

(858) 481-8182 (Outside the USA)

Fax: (858) 350-9380

Web: www.redlake.com

Mailing Address:

Redlake

6295-A Ferris Square

San Diego, California 92121

For international customers, please contact your authorized Redlake Distributor for information. You may also contact one of the following Redlake service centers:

Roper Scientific BV (Europe, Middle East and Africa):

Telephone: (31) 347 363 954

Fax: (31) 347 363 955

Email: flangeweg@roperscientific.com

Mailing Address:

Lang Dreff 15F

4131 PN Vianen

Nederland

Nippon Roper KK, Japan: (For Japan Only)

Telephone: (81) 3-5639 2770

Fax: (81) -3 -5639 2775

Email: ishiba@roper.co.jp

Mailing Address:

6F Sakurai Building

2819 Fukagawa Koto Ku

Tokyo, 135-0033

Japan

Asia/Pacific:

Redlake

Telephone: +65-6293-4758

Fax: +65-6293-3307

10 Eunos Road 8 #12-06

Singapore Post Centre 408600

Singapore

17.3. Warranty

For a period of one (1) year from the date of shipment, Redlake MASD LLC (hereafter referred to as Redlake), warrants that the *MotionXtra* imager, and accessories manufactured by Redlake (collectively the "Product") are in conformity with published specifications and that such items are of good material and workmanship. If any item is defective in material or workmanship or otherwise fails to meet the specifications, or fails to function properly, the Purchaser shall have the right to return such defective or nonconforming products to Redlake for correction or replacement.

Redlake agrees to repair or replace, at Redlake's discretion, without charge, any item that is returned to Redlake for inspection, provided such inspection discloses to the satisfaction of Redlake that the defects are as specified and conform to the provisions of the New Product Warranty. Redlake shall have no obligation under this New Product Warranty to provide local repair or replacement services for the Product, but will, at Redlake's sole discretion, provide repair or replacement services at its own factory or a designated service facility. Products shall not be returned to the Redlake factory or a designated service facility for inspection, replacement, or repair without specific written authorization from Redlake. Redlake will grant such authorization with the issuance of a Return Material Authorization (RMA) number provided that the Purchaser shall have notified Redlake of any defect or nonconformance within thirty (30) days after Redlake's shipment of the Product.

THIS WARRANTY DOES NOT APPLY TO THE FOLLOWING CONDITIONS:

Damage caused by a failure to operate the Product in accordance with Redlake's written instructions as provided in the Redlake user manual, including but not limited to, environmental specifications, evidence of Product being subjected to accidental damage, misuse, abuse, or tampering including the removal, alteration or defacing of Product identification markings;

Damage resulting from the unauthorized attempt to repair or modify the Product by non-Redlake personnel; Damage caused during shipment.

This warranty and Redlake's obligation hereunder are in lieu of all other warranties and Redlake makes no other warranties, express or implied, including, but not limited to, warranties of fitness, non-infringement, or merchantability. Under no circumstances shall Redlake be liable for special or consequential damages, including, but not limited to, any claimed loss of profits. Redlake's liability shall be exclusively limited to the repair or replacement of any defective or nonconforming Product and the Purchaser expressly waives any other remedy or measure of damage, statutory or otherwise.

18. Appendix F Troubleshooting

18.1. About Box

The Help menu command opens an About dialog box containing revision, copyright and system information for the program. If you need to contact a field services technician regarding your system, your technician may ask you to provide this information in a text file to assist in troubleshooting your system.



Figure 65: About Box

18.1.1. Insert System Information

1. Click in the box labeled "Click here to gather system information".
2. *MotionCentral* will write the host PC information into the box.
3. Copy this information to the Microsoft Windows clipboard and transfer it into a text file for reference.

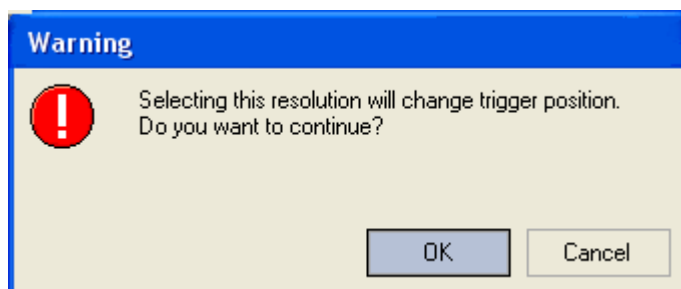
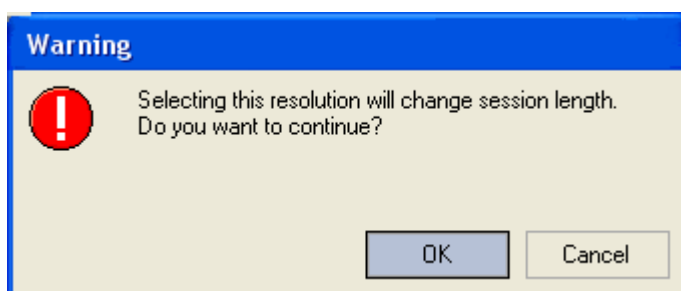
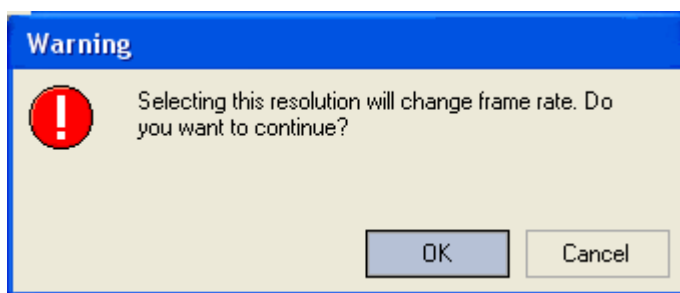
18.2. Side Effect Alerts

There are dependencies among camera parameters where setting one parameter may affect another. For example, selecting a resolution of 1504 x 1128 requires that the camera has a frame rate of 1000 fps or less. If the operator selects a frame rate of 2000 fps, and the resolution is set to 1504 x 1128 then the system will generate a message to warning the user that setting this resolution will cause the Side Effect of reducing the frame rate.

Similarly, if the user specifies a frame rate too great for the currently specified exposure setting, the program displays an alert box. When this box displays, cancel the frame rate change, or accept it and the exposure will decrease to the largest value acceptable for the frame rate.

The resolution setting also affects the Session Length. If the user specifies a resolution too large for the currently specified Session Length, the program displays an alert indicating that the session length will be affected. Cancel the resolution change or accept it and the session length setting will decrease to a value compatible with the session length.

Session Length affects the position of the trigger among the saved frames. If the current trigger position would no longer be compatible with the pre- and post-trigger settings, the program displays an alert that the trigger position settings will be affected. Cancel the Session Length change or accept it, in which case the trigger position setting will change to an acceptable value.



19. Appendix G Formulas

Definitions

INT	Integer function: round down to nearest integer (i.e., truncate fractional part).
Width	Sensor active area width, in pixels. Width must always be an integral multiple of 32, greater than or equal to 32.
Height	Sensor active area height in pixels. Height must always be an integral multiple of 8, greater than or equal to 16.
SessionLength	Number of frames that the camera can hold in its image memory.
Rate	Maximum record frame rate allowed by camera, expressed in frames per second.
FPS	Frames Per Second
ExposureSetting	The nominal exposure, in microseconds, set in the camera (e.g. via the "Set Exposure" command).
ExposureTime	Actual light integration time for the camera's CMOS sensor, in microseconds.
ExposureStartDelay	The time, in microseconds, between an active edge on Sync In and camera shutter open.
StrobeDelaySetting	The nominal strobe delay, in microseconds, set in the camera.
StrobeDelay	Difference between the active edge at the camera's Strobe output and the actual start of integration time at the camera's CMOS sensor, in nanoseconds.
TriggerDelaySetting	The nominal Trigger Delay, in microseconds, set in the camera.
TriggerDelay	Difference between the detection of an active Trigger input (camera or hub) and the recognition of the trigger event by cameras, in microseconds.

Table 15: Formula Definitions

19.1. Session Length

The number of frames that will fit into capture memory (i.e. the maximum session length) is given by:

$$SessionLength_{Min} = 1$$

Equation 1: Session Length Equation for all models

HG-100K with 2 GB of memory

$$SessionLength_{Max} = 2 \times INT \left(\frac{268,435,424}{\frac{Width \times Height}{4} + 32} \right)$$

HG-100K with 4 GB of memory

$$SessionLength_{Max} = 4 \times INT \left(\frac{268,435,424}{\frac{Width \times Height}{4} + 32} \right)$$

HG-LE with 1 GB of memory

$$SessionLength_{Max} = 1 \times INT \left(\frac{268,435,424}{\frac{Width \times Height}{4} + 32} \right)$$

HG-LE with 2 GB of memory

$$SessionLength_{Max} = 2 \times INT \left(\frac{268,435,424}{\frac{Width \times Height}{4} + 32} \right)$$

HG-TH with 2 GB of memory

$$SessionLength_{Max} = \frac{2}{\#ofheads} \times INT \left(\frac{268,435,424}{\frac{Width \times Height}{4} + 32} \right)$$

HG-TH with 4 GB of memory

$$SessionLength_{Max} = \frac{4}{\#ofheads} \times INT \left(\frac{268,435,424}{\frac{Width \times Height}{4} + 32} \right)$$

HG-TH with 8 GB of memory

$$SessionLength_{Max} = \frac{8}{\#ofheads} \times INT \left(\frac{268,435,424}{\frac{Width \times Height}{4} + 32} \right)$$

19.2. Frame Rates

Running in Normal mode, the camera uses its internal frame rate generator. The internal frame rate generator supports a set of specific frame rates (60, 125, 250, etc.), as described in the HG-100K/LE/TH Command Protocol document. The camera will only accept frame rate settings that do not exceed $Rate_{Max}$, as given. For example, at 1504×1128 , $Rate_{Max}$ is 1034.6 frames per second. The fastest rate available from the internal frame rate generator that does not exceed this value is 1000 frames per second.

When using the camera's Sync In input, the camera is not limited to the specific frame rates generated by the internal frame rate generator. In this mode, the camera will run at any frame rate, provided $Rate_{Max}$ is not exceeded.

$$Rate_{Min} = 30$$

Equation 2: Frame Rate Equation

HG-100K

$$Rate_{Max} = \min \left\{ \begin{array}{l} \frac{10^9}{7,467 + \frac{Height}{4} \left(267 + 16.67 \frac{Width}{8} \right)} \\ \frac{10^6}{ExposureSetting + 3} \end{array} \right.$$

HG-LE

$$Rate_{Max} = \min \left\{ \begin{array}{l} \frac{10^9}{7,467 + \frac{Height}{4} \left(267 + 16.67 \frac{Width}{4} \right)} \\ \frac{10^6}{ExposureSetting + 3} \end{array} \right.$$

HG-TH

$$Rate_{Max} = \min \left\{ \begin{array}{l} \frac{10^9}{7,467 + \frac{Height}{2} \left(267 + 16.67 \frac{Width}{8} \right)} \\ \frac{10^6}{ExposureSetting + 3} \end{array} \right.$$

Note: That the maximum frame rate is limited by both the sensor resolution and by the exposure setting, whichever is most restrictive.

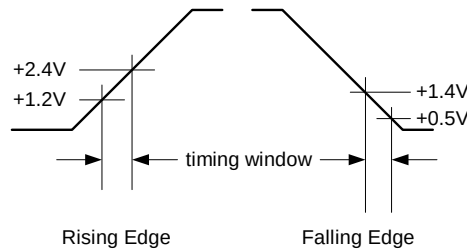
Frame rate calculation is adapted from sensorFpga.c:sensorFpgaMinFsync(), its subroutines and various constants.

Rates lower than 30 fps may be applied at the camera's SYNC IN input when the camera is running in External Sync mode. At frame rates lower than 30 fps, the picture quality may degrade.

Rates greater than $Rate_{Max}$ may be applied at the camera's SYNC IN input when the camera is running in External Sync mode. However, the camera will only recognize a request to start a new exposure (active edge on SYNC IN) after $1/Rate_{Max}$ seconds have passed since the start of the last exposure. That is, the camera will not expose frames at a rate greater than that allowed by the current sensor area (resolution) and exposure settings.

19.3. External Sync Exposure Timing

With the camera in External Sync mode, the user may configure the SYNC IN input to recognize either rising or falling edges as requests to begin an exposure. The camera will recognize a rising edge as the input level rises through the +1.2V to +2.1V range. The camera will recognize a falling edge as the input level falls through the +1.4V to +0.5V range. Long transition times on SYNC IN will introduce greater uncertainty in the precise time that the camera starts an exposure, as shown. To minimize the uncertainty in exposure timing, keep transitions times on SYNC IN short.



Equation 3: External sync timing diagram

Each time the camera completes an exposure, it begins a readout process that moves captured image data from the sensor's photodiodes to the camera's image memory. The sensor's pixels read out row by row. The sensor requires a brief pause between each row read out. The sensor's shutter only opens during these pauses, or after the read out process for the previous frame has completed. This means that the camera may not be able to open the shutter precisely on the active edge of SYNC IN, or even with a consistent delay after the active edge. There is some variation in when the shutter will actually open, based on when the active edge arrives relative to the read out of the previous frame.

The minimum delay from SYNC IN to start of exposure ($ExposureStartDelay_{Min}$) will occur when the sensor readout process has completed by the time the SYNC IN edge arrives at the camera. In this case, there is no additional delay required for the exposure process to synchronize with the sensor readout process.

$$ExposureStartDelay_{Min} = 0.0$$

Equation 4: External sync for all models

HG-100K

$$ExposureStartDelay_{Max} = 2.3 + 0.01667 \left(\frac{Width}{8} \right)$$

HG-LE/TH

$$ExposureStartDelay_{Max} = 2.3 + 0.01667 \left(\frac{Width}{4} \right)$$

In order to recognize a valid exposure request, an input pulse on SYNC IN must be at least 4μ wide.

19.4. Exposure Time

The actual time that the sensor's shutter is open is longer than the nominal exposure time set through the camera's command interface. In addition, for reasons similar to those described above for the variations in exposure start times, there is some variation in actual exposure times that depends on the arrival time of an exposure request relative to the sensor readout process.

For exposure settings of 5 or 6 μs:

$$ExposureTime = ExposureSetting \pm 0.1$$

Equation 5: Exposure Time 5 or 6 μs for all models

For exposure settings 7 μs and longer:

HG-100K

$$ExposureTime_{Min} = ExposureSetting - \left(2.1 + 0.01667 \left(\frac{Width}{8} \right) \right)$$

HG-LE/TH

$$ExposureTime_{Min} = ExposureSetting - \left(2.1 + 0.01667 \left(\frac{Width}{4} \right) \right)$$

The shortest exposure occurs when the active edge of Frame Sync arrives just as a row readout is starting. In this case, the start of exposure is delayed for one complete row readout time ($0.267 + Width/8$), and then delayed by the TsuSRS (1.7uSec). These delays are subtracted from the "normal" long exposure time. The net is an exposure that runs a couple of μs longer than the setting, instead of 4.2uSec longer.

$$ExposureTime_{Max} = ExposureSetting + 0.1$$

Equation 6: Exposure Time 7 μs and longer all models

19.5. Strobe Output Timing (with internal frame rate generator)

When the Strobe Delay setting in the camera is less than or equal to zero, the Strobe output will lead the actual start of exposure. The minimum lead-time is given by:

$$StrobeDelay_{Min} = -StrobeDelaySetting$$

Equation 7: Strobe Output Timing Equation

The maximum lead-time is given by:

HG-100K with a Strobe Delay Setting of +0.10

$$StrobeDelay_{Max} = \begin{cases} -StrobeDelaySetting + 0.10, & ExposureSetting < 7 \\ -StrobeDelaySetting + 2.2 + 0.01667\left(\frac{Width}{8}\right), & ExposureSetting \geq 7 \end{cases}$$

HG-LE/TH with a Strobe Delay Setting of +0.10

$$StrobeDelay_{Max} = \begin{cases} -StrobeDelaySetting + 0.10, & ExposureSetting < 7 \\ -StrobeDelaySetting + 2.2 + 0.01667\left(\frac{Width}{4}\right), & ExposureSetting \geq 7 \end{cases}$$

HG-100K with a Strobe Delay Setting of -0.10

$$StrobeDelay_{Min} = \begin{cases} StrobeDelaySetting - 0.10, & ExposureSetting < 7 \\ StrobeDelaySetting - \left(2.2 + 0.01667\left(\frac{Width}{8}\right)\right), & ExposureSetting \geq 7 \end{cases}$$

HG-LE/TH with a Strobe Delay Setting of -0.10

$$StrobeDelay_{Min} = \begin{cases} StrobeDelaySetting - 0.10, & ExposureSetting < 7 \\ StrobeDelaySetting - \left(2.2 + 0.01667\left(\frac{Width}{4}\right)\right), & ExposureSetting \geq 7 \end{cases}$$

$$StrobeDelay_{Max} = StrobeDelaySetting$$

19.6. Hardware Trigger Delay through Hubs

The camera will designate one frame in its image memory as Frame 0. Frames recorded after Frame 0 are numbered 1, 2, 3.... Those recorded prior to Frame 0 are numbered -1, -2, -3.... Frame 0 is the frame whose exposure started most recently at the time the camera recognized the Trigger event. That is, the time that the camera recognizes the Trigger event is always prior to the time Frame 1's exposure started, but after (or at) the time Frame 0's exposure started.

There is always a delay from the time the Trigger signal enters the system (at a Hub or camera TRIGGER input), until the cameras recognize the Trigger event. The minimum and maximum delays are expressed here in microseconds:

$$TriggerDelay_{Min} = TriggerDelaySetting + 650$$

$$TriggerDelay_{Max} = TriggerDelaySetting + 750$$

Equation 8: Trigger Delay

The variations between minimum and maximum trigger delays shown above apply from one recording to the next. For one recording, the variation in the trigger delay among cameras in a system is limited to $\pm 1\mu s$

20. Appendix H Cable Specifications

20.1. Camera Power Pigtail

This cable carries power to the cameras 2 m in length.

Pin	Signal Name	Color
B	CAM_PWR_RET	GREEN
C	CAM_PWR	ORANGE
D	CAM_PWR	RED
E	CAM_PWR	WHITE
F	CAM_PWR_RET	BLACK
N	CAM_PWR_RET	BLUE
P	CAM_PWR	YELLOW
S	CAM_PWR_RET	BROWN

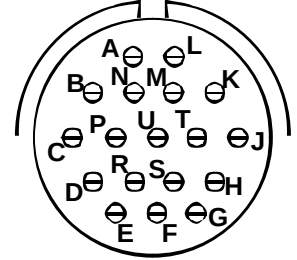


Figure 66: Cable Specifications: camera power pigtail

20.2. HSU Power Cable

This cable carries power to the cameras.

Pin	Signal Name	Color
A	CAM_PWR	ORANGE
B	CAM_PWR	RED
G	CAM_PWR	WHITE
F	CAM_PWR	YELLOW
C	CAM_PWR_RET	GREEN
D	CAM_PWR_RET	BLUE
E	CAM_PWR_RET	BROWN
H	CAM_PWR_RET	BLACK

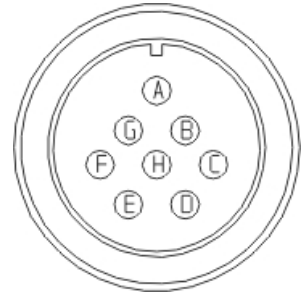


Figure 67: Cable Specifications: HSU power cable

20.3. STP Cable Lengths and Timing

The Sync/Trigger/Power (STP) cables that connect cameras to hubs, and hub to hubs, carry the signals that cameras use to synchronize themselves to one another. Differences in total STP cable length between the root hub and various cameras will introduce small skews in the timing among cameras.

The STP cables add about 6 ns per meter of propagation time to the trigger and synchronization signals. Therefore, in a five-hub, two-camera system, one camera could be connected with a short (5 m) STP cable, while the other could have a total of 500 m of cable in the path to the root hub, for a cable length difference of 496 m. The downstream camera's timing would be skewed almost 3 μ s behind the upstream camera. This skew would affect the frame synchronization between the two cameras. In addition, this delay will add to the Trigger Delay time, if the trigger signal applies to the downstream camera.

20.3.1. Synchronization/Timing/Power Cable (STP)

This cable carries synchronization, timing and power from the HSU to the cameras. Order it in lengths from 1 m to 100 m. The cable has a nominal outside diameter of 0.43 inches (10.92 mm).

HSU -side		Camera -side		Wire Type/Size
Pin	Signal Name	Pin	Signal Name	
G	TRIG_RET-	J	TRIG_RET-	24AWG, Blue/White
H	TRIG_RET+	K	TRIG_RET+	24AWG, Red/White
T	SHIELD GND	T	SHIELD GND	24AWG, Red/White
J	SYNC_OUT-	G	SYNC_IN-	24AWG, Blue
K	SYNC_OUT+	H	SYNC_IN+	24AWG, Red
T	SHIELD GND	T	SHIELD GND	24AWG, Red
A	PWR_RSTA	A	PWR_RSTA	20AWG, Jumper
L	PWR_RSTB	L	RWR_RSTB	20AWG, Jumper
B	CAM_PWR_RET	B	CAM_PWR_RET	20AWG, Single, Black
C	CAM_PWR	C	CAM_PWR	20AWG, Single, Red
D	CAM_PWR	D	CAM_PWR	20AWG, Single, Red
E	CAM_PWR	E	CAM_PWR	20AWG, Single, Red
F	CAM_PWR_RET	F	CAM_PWR_RET	20AWG, Single, Black
N	CAM_PWR_RET	N	CAM_PWR_RET	20AWG, Single, Black
P	CAM_PWR	P	CAM_PWR	20AWG, Single, Red
R	CAM_PWR	R	CAM_PWR	20AWG, Single, Red
S	CAM_PWR_RET	S	CAM_PWR_RET	20AWG, Single, Black
U	CAM_PWR_RET	U	CAM_PWR_RET	20AWG, Single, Black
M	NOT CONNECTED	M	NOT CONNECTED	

Table 16: Pin and Signal Names

20.4. Ethernet Communications Cable

Low-G Applications: Standard Ethernet Cable with RJ-45 connectors.

High-G Applications: Ethernet Cable with RJ-45 connectors with hardened shroud and threaded locking ring.

20.5. HG-TH Tethered Head Cables

HG-TH Cable, tethered, 3 meter Part Number: 30007082-001

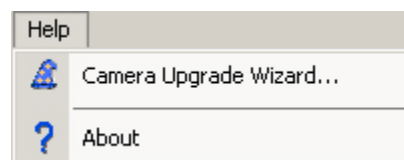
HG-TH Cable, tethered, 6 meter Part Number: 30007082-002

HG-TH Cable, tethered, 10 meter Part Number: 30007082-003

21. Appendix I Upgrade Camera Using the Upgrade Wizard

21.1. HG-100K/LE Camera Upgrade

1. Insert the upgrade CD into the CD-ROM drive of the computer or download the upgrade from the Redlake ftp site.
 2. Select the Camera Upgrade Wizard from the Help menu. From the Introduction menu, click the Next button to go to file selection.
 3. Select the browse button to open the upgrade folder for either the HG-100K or HG-LE.
 4. Open the *.upg file in the folder and click on the Next button.
 5. Select the camera(s) to upgrade and click on the Next button to start the upgrade.
- Once the upgrade is completed, the camera(s) will automatically reset.



21.2. HG-TH Camera Head and Camera Controller Upgrade

Upgrade the Camera Head(s) and Camera Controllers in separate procedures. Camera Heads can only be updated on the HD1 Camera Head port on the Camera Controller.

In systems with multiple Camera Heads and multiple Camera Controllers, upgrade multiple Camera Heads simultaneously by connecting each Camera Head to the HD1 Camera Head port on the Camera Controller. Use the same procedure as for updating a single Camera Head and Controller.

1. Connect a Camera Head to the HD 1 Camera Head port on the Camera Controller.
2. Select the camera from the Camera List.
3. Insert the upgrade CD into the CD-ROM drive of the computer or download the upgrade from the Redlake ftp site.
4. From the Help menu, select the Camera Upgrade Wizard. Click on the Next button on the Introduction window to proceed with the installation.
5. From the File Selection window, select the browse button to open the upgrade folder for either the Camera Head or the Camera Controller.
6. Open the *.upg file in the folder and click on the Next button.
7. From the Select Cameras Window, verify the Camera Head or Camera Controller and the appropriate upgrade. Select the Camera Head or Camera Controller to upgrade and click on the Next button to start the upgrade.

Once the upgrade is completed, the camera(s) will automatically reset.

22. Appendix J Glossary

Term	Definition
100Base-TX	Abbreviation for 100BASE-TX Ethernet local area network (LAN).
1000Base-T	Abbreviation for 1000BASE-T Ethernet LAN. Also called Gigabit Ethernet.
AVI	Audio Video Interleaved (file extension for video files).
Bayer	The Bayer image file format output of Legacy Redlake cameras.
Camera	A component of the HG-100K/LE/TH system that contains the sensor and captures and stores the images.
Camera Control Unit (CCU)	A component of the HG-100K/LE/TH system that is a commercial personal computer that runs the control software
Camera Controller	A component of the HG-TH system that provides the power, Ethernet LAN connections and memory
CMOS	The acronym for Complementary Metal Oxide Semiconductor.
Camera Head	The component of the HG-TH system that provides the imaging.
Display Control Unit (DCU)	The Display Control Unit (DCU) is the commercial Tablet PC used locally to set up and focus a camera. It is used to view images and perform emergency downloads.
fps	The acronym for frames per second.
GB	The acronym for gigabyte.
GUI	Graphical User Interface (also UI).
High-G	Refers to the Vehicle Impact Test or similar environment that includes up to 100-G shock and 5-G vibration stress. Generally indicates ability to withstand extreme shock and vibration forces.
Hub Sync Unit (HSU)	Commercial Gigabit switch and precision sync, and trigger timing device in a High-G format.
IRIG/GPS Time	Inter-Range Instrumentation Group/Global Positioning System Time. Time code signals of various formats defined by the IRIG 200-98 standard/time derived from GPS satellites. Both require an optional receiver/decoder/generator module.
LAN	The acronym for Local Area Network.
Legacy	Refers to the older Redlake cameras currently in use. Specifically HG-100X, HG-2000, HG-TX, and CR-2000.
Low-G	Refers to a general industrial environment with less than 10-G shock and 2.5-G vibration stresses.
MHz	The acronym for megahertz.
<i>MotionCentral</i>	A software interface that allows the user to configure and control the operation of the HG-100K/LE/TH and Redlake Legacy Camera systems.
Network Interface Controller (NIC)	Acronym for Network Interface Controller. NIC is a device that provides an interface between the network physical media and the external systems.
PC	The acronym for Personal Computer.
Type-2	The new image file format of HG-100K/LE/TH (Bayer, with expanded header data).

Table 17: Glossary of Terms